A BIBLIOMETRIC REVIEW ON EXPLORING THE ROLE OF ARTIFICIAL INTELLIGENCE IN DISRUPTIVE INNOVATION

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ABSTRACT

This research investigates the impact of Artificial Intelligence (AI) on fostering disruptive innovation with an exploration of AI's profound effects on the global economy. The evolution of AI's and its role in innovations has disrupted many traditional industries and is still. The evolution of these paradigms underscores the dynamic nature of AI and its potential to optimize processes and generate novel solutions. It employs bibliometric analysis to explore the academic landscape of AI-driven innovation, using citation metrics and thematic mapping to identify key research trends and gaps. The empirical findings include the co-occurrence network of AI and disruptive innovation, thematic evolution, and trends in scientific production, highlighted through visual representations such as keyword maps and thematic diagrams. The research underscores the importance of ethical considerations in AI deployment and provides insights into leveraging AI to maximize societal benefits while minimizing risks. Future research and policy formulation are offered to ensure responsible AI innovation. In conclusion, this study provides a comprehensive overview of AI's role in driving disruptive innovation with a deeper understanding of the relationship between AI and disruptive innovation, offering valuable insights for academics, industry practitioners, and policymakers, and supporting informed decision-making and strategic planning in the AI-driven transformation era.

Keywords: Artificial Intelligence, Disruptive Innovation, Bibliometrics, Bibliometric Analysis, Citation Analysis, Co-citation Analysis

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Brian Akabagy Enyiawah

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CHAPTER 1
INTRODUCTION

Artificial Intelligence (AI) has rapidly emerged as a transformative force, revolutionizing industries and redefining the landscape of innovation. This chapter explores the pivotal role of AI in driving disruptive innovation. By delving into the background and context of the study (Section 1.1), we establish the foundational relevance of this research. The problem statement (Section 1.2) outlines the core challenges and questions this study aims to address. Section 1.3 will detail the research objectives and questions guiding our inquiry, followed by the scope of the research (Section 1.4). The significance of this research (Section 1.5) underscores the critical implications for stakeholders in understanding and harnessing AI-driven innovation. Finally, Section 1.6 provides clear definitions of key terms used throughout this study, ensuring clarity and precision in our discourse.

1.1 Background and Context of the Study

Currently, the globe is experiencing a wave of disruptive technological advancements propelled by artificial intelligence (AI). For instance, AI-driven technologies like autonomous vehicles are transforming the transportation sector, while AI algorithms in healthcare are enhancing diagnostic accuracy by up to 40% and accelerating drug discovery processes. Furthermore, a recent report by McKinsey Global Institute estimates that AI could contribute up to $13 trillion to the global economy by 2030, highlighting its profound impact on various industries. These disruptive innovations have affected almost every sector of our lives be it business, health, and travel, or other day-day activities (Akinsola et al., 2022). As such when disruptive innovation is mentioned, technology always follows such as (AI, Nanotechnology, robotics, Internet of Things, Virtual Reality (VR) and Augmented Reality, etc.), AI which has revolutionize most industries and bringing new ones to lamplight. This is partially due to the rapid advancement of the 4th industrial revolution powered by AI thus, leading to numerous business model shifts which is significant in most competitive environment and industries (Chen & Shen, 2019).

Historically, disruptive innovation always threatens or modifies established markets by changing the consumer behavior, market hierarchies, through bringing new ways of engagement and value creation within any industry. AI enhances the acceleration of disruption and acts as a catalyst for the creation of new products and business models by using technology to converge the biological sphere, physical, and digital. This has resulted in industries as diverse as manufacturing, healthcare, finance, and retail experiencing a huge transformation driven by the application AI revolution which appears to be endless. As such, these disruptive innovations in recent years have become more frequent than before. With AI spreading its wings into different industries, concerning issues involving ethical considerations emerge, varying significantly depending on the industry or business environment. For instance, in healthcare, AI-driven diagnostic tools raise concerns about patient privacy and data security, as sensitive medical information is processed and stored. In the financial sector, AI algorithms used for credit scoring and loan approvals can perpetuate biases, leading to unfair treatment of certain demographic groups. Additionally, in the realm of autonomous vehicles, ethical dilemmas arise regarding decision-making in life-threatening situations, such as prioritizing the safety of passengers versus pedestrians. These examples highlight the diverse and complex ethical challenges that accompany the widespread adoption of AI across different sectors. As a result, stakeholders, business leaders, and policymakers from all economic disciplines must maneuver a multiplex landscape of a powerful transformative AI consisting of an ever-changing technological environment thus breathing uncertainties.

1.2 Problem Statement

The purpose of studying disruptive innovation in the context of AI is to address the significant gap in understanding how AI-driven innovations outpace the ability of regulatory bodies and organizations to keep up. This leads to challenges in effectively strategizing for AI's long-term implications. By investigating this gap, the study aims to provide insights that can help stakeholders better understand and manage the transformative impact of AI on various industries. This also means that entrepreneurs can use disruptive innovation insights to identify gaps in the market,

discover underserved needs or overlooked customer segments and create novel solutions to it. This is because disruptive innovation helps us to understand the transformation and evolution of various industries. By studying disruptive technologies through AI, we gain -insights into how existing markets shift, new markets emerge, and business models adapt. The problem statement, therefore, revolves around where AI presently stands, where it is going, and what trends are the most involved. This is because though AI has shown some great potential, there is still uncertainty on the trajectory it may drive societies to and its impact on innovation. According to Chen and Shen (2019), businesses are trying to input AI into all their operations, but the challenge comes in predicting the AI-induced disruption will reshape distribution, market capital, and employment across diverse stakeholders. This research seeks to address the need for a comprehensive meta-analysis of existing literature on AI and its disruptive potential, encompassing industry impacts, and future research directions.

1.3 Research Objective and Questions

The primary objective of this research is to examine the dynamics of disruptive innovation driven by AI. The research questions are designed to probe deeply into the nature of AI as a catalyst for disruption: Key research questions include.

RQ1: What are the keyword relationships between AI and disruptive innovation in academic literature?

RQ2: What are the predominant research themes surrounding AI-driven disruptive innovation within academic literature?

RQ3: What are the emerging trends and technology surrounding AI-driven disruptive innovation?

1.4 Research Scope

The scope of this research is to conduct a bibliometric analysis of literature on AI-driven disruptive innovation. The study will focus on academic articles indexed in the Scopus database, covering the period from 1831 to 2024 to capture the modern era

of AI development. This approach allows for a robust analysis of research patterns, collaborative networks, emerging trends and themes driving the discourse.

1.5 Significance of the Research

This research will contribute to academia by enriching scholarly discourse and reinforcing theoretical underpinnings related to the economics of innovation and technology. By providing empirical insights and employing bibliometric methods, it aims to identify key research interests, gaps, and the developmental trajectory of AI-related research. This will assist scholars in navigating the vast corpus of academic work on AI-driven innovation, facilitating a more informed approach to research and publication. For example, understanding the major themes and influential works in AI-driven innovation can help scholars focus their studies on emerging trends and underexplored areas.

The findings of this research will have significant implications for businesses and practitioners across industries. By exposing patterns of disruption and identifying the next wave, it will guide strategic responses and inform decision-making processes within organizations. For instance, businesses can use the insights gained from the research to anticipate AI-driven disruptions in their sectors, adapt their business models, and leverage AI technologies to gain a competitive advantage. Moreover, the research will help businesses navigate the rapidly evolving landscape of AI development, enabling them to make informed investments in AI research, development, and implementation.

Other stakeholders, including policymakers, regulatory bodies, and the public, will benefit from the insights generated from this research. By providing indications of AI-driven innovation, the research will inform policy formulation and guide legislative frameworks aimed at fostering responsible AI development and deployment. Policymakers can use the findings to develop regulations that balance innovation with ethical considerations, ensuring that AI technologies are deployed in a manner that maximizes societal benefit while minimizing potential risks. For example, policies could be crafted to address ethical concerns such as data privacy and job displacement caused by AI. Additionally, the research will enhance public understanding of the societal implications of AI and empower stakeholders to

participate in informed discussions about the role of AI in shaping the future of industries and economies.

In conclusion, by employing bibliometric methods, this study aims to provide an empirical, data-driven perspective on the academic investigation of AI's impact on disruptive innovation. The significance lies in identifying key research interests and gaps, mapping the developmental trajectory of AI-related research, and assisting stakeholders in navigating the rich corpus of academic work on AI-driven innovation. This, in turn, can facilitate a more informed approach to policy formulation, business strategy development, and understanding the societal implications of AI.

1.6 Definition of Terms

Artificial Intelligence: A field of computer science that focuses on the creation of systems capable of performing tasks that typically require human intelligence. (Copeland & Proudfoot, 2007).

Disruptive Innovation: It is a process where a smaller company challenges larger, established businesses by entering a low-end or new market segment (Christensen,1997).

Bibliometrics: Essentially, bibliometrics is the application of quantitative analysis and statistics to publications such as journal articles and their accompanying citation counts (Aria & Cuccurullo, 2017).

Bibliometric Analysis: A research method that uses bibliometric tools to analyze academic literature and scholarly publications. It involves measuring and analyzing various aspects such as publication counts, citation counts, and authorship patterns to understand research trends and the impact of scientific works.

Citation Analysis: A technique within bibliometrics that examines the frequency, patterns, and graphs of citations in articles and books. It is used to gauge the influence and impact of a particular work or author by analyzing how often they are cited by other researchers.

Co-citation Analysis: A method of bibliometric analysis that examines how often two documents are cited together by subsequent documents. This technique helps to identify the relationships between different research papers and can reveal the

structure of a research field by showing how often various works are referenced together.

CHAPTER 2
LITERATURE REVIEW

AI is slowly shifting from science fiction to a convincing reality that is affecting nearly every sector in modern society (Davenport & Ronanki, 2018; Christensen, Raynor, & McDonald, 2015; Kaplan & Haenlein, 2019). According to Strydom and Buckley (2019), AI evolution continues to disrupt and alter long-standing market structures and business models. This chapter presents an ample review of the existing body of knowledge on the interplay of AI and disruptive innovation. Specifically, it aims to critically analyze the existing literature on how AI contributes to disruptive innovation across various industries. Understanding this relationship is crucial in the current business landscape as AI has the potential to transform industries by introducing groundbreaking technologies and business models. By examining how AI drives disruptive innovation, this chapter seeks to provide insights into the opportunities and challenges that organizations face in adapting to and leveraging AI technologies for sustained competitive advantage. It seeks to provide understandings into current research, mark out the intellectual space, and show the numerous ways in which AI has been seen as an activator and a transformative force in different industries worldwide. By exploring these terrains, it aims at giving clarification to the growing knowledge and show the thematic gap offering for future exploration. Thus, this chapter establishes a strong foundation for an empirical examination of AI's role in shaping the future of disruptive innovations. So, this chapter will examine the concept of AI 2.1, then move to 1.2.1 which is the historical perspective and evolution of AI, 2.2 will cover the concept of disruptive innovation after that, 2.2.1 will explore the historical perspective and evolution of disruptive innovation. Finally, 2.3 will examine the AI-driven disruptive innovation.

2.1 Concept of Artificial Intelligence (AI)

Artificial intelligence is the imitation of human intelligence processes by machines, especially computer systems (McCarthy, 1956). The procedure includes learning, reasoning, and self-correction. According to Russel (2016), AI can be broadly grouped into narrow or weak AI (design for specific task) and general or

strong AI which covers broader human-like capacities. The field of AI has a wide range of concepts commonly discussed they include Symbolic AI, Connectionist AI, Evolutionary AI, Bayesian AI, Hybrid AI, and Ethical AI.

Symbolic AI, also known as classical AI or rule-based AI, represents knowledge using symbols and formal logic. This concept was coined by McCarthy et. al (1955), as he proposed a logic-based approach to AI where it operates based on rules and logic to manipulate symbols and perform tasks such as reasoning, planning, and problem-solving. Expert systems and rule-based systems are examples of symbolic AI approaches developing a representation scheme (Minsky, 1961). But it still encounters some limitations when learning from data and adaptation to new situations. In industries like finance, this AI can disrupt the traditional ways of automating decision-making processes based on predefined rules.

Connectionist AI is also known as neural networks or connectionist models, was inspired by the structure and function of the human brain. This method was defended by McCulloch and Pitts (1943), they proposed a simple model of artificial neurons and displayed how networks of these neurons could perform computational tasks by linking interconnected nodes (artificial neurons) organized into layers as such, each connection has a weight representing its importance. Hinton et. al (2006), also contributed to the study of neural networks learn from data by adjusting these weights to reduce errors and make predictions or classifications. Thereby making groundbreaking revolutionary contribution to deep learning, a subset of connectionist AI, involving deep neural networks with several layers, enabling the model to learn hierarchical representations of data. It is substantially efficient at pattern recognition and learning from large datasets with its computational power, and its decision-making process is sometimes opaque (black box issue). It applies predictive analytics and is well known for image and speech recognition as well as in healthcare and automotive industries, driving innovation through developments in diagnostic systems and autonomous vehicles.

Holland (1975) is considered the pioneer of Evolutionary AI and was inspired by the biological principles of evolution, using evolutionary algorithms to search and optimize solutions to problems. He developed the concept of genetic algorithms based on principles of natural selection and evolution such as mutation, recombination, and

selection. De Jong (2017) also applied evolutionary AI in various fields for optimization dilemmas, evolutionary robotics, and generating creative solutions. It is particularly good at generating creative solutions to problems optimization but sometimes needs computational resources and can be slow to rely on optimal solutions. Evolutionary AI has disrupted the of fields robotics, game development, and engineering design by optimizing complex processes, creating novel product designs, in manufacturing and logistics.

Bayesian AI incorporates principles of Bayesian probability theory to reason under uncertainty and make decisions based on probabilistic inference. Although Bayes (1763), was not directly associated with AI, his probability theory laid the foundation of Bayes' theory. These models represent uncertainty using probability distributions and update beliefs based on evidence using Bayes' theorem. Pearl (1988) is an important figure in the field of artificial intelligence and causal reasoning, Pearl made considerable inputs to Bayesian networks and probabilistic graphical models. He developed the framework of causal inference and received the Turing Award for his work on AI. It is robust in dealing with uncertainty and incorporating prior knowledge. It can be computationally intensive and may struggle with very large datasets. Bayesian AI is used in predictive modeling, risk assessment, and decision-making systems. In finance and insurance, it can revolutionize risk management and predictive analytics, offering more accurate and dynamic models.

Hybrid AI combines multiple AI approaches, such as symbolic AI, connectionist AI, and evolutionary AI, to leverage the strengths of each approach and address the limitations of individual techniques. Hybrid AI systems may integrate rule-based reasoning with neural networks, evolutionary algorithms with symbolic reasoning, or other patterns to implement complex problems more effectively. It provides more flexible and comprehensive solutions by integrating different AI methodologies. It can be complex to implement and manage. Hybrid AI is used in advanced decision-support systems and complex simulations. In sectors like smart cities and environmental monitoring, hybrid AI can integrate diverse data sources and analytic methods to drive innovative solutions.

Ethical AI is a concept that focuses on the societal and ethical implications of AI technologies, including issues such as bias, fairness, transparency, accountability,

and privacy. Crawford and Joler (2018) are the leading scholars in AI ethics, Crawford has conducted broad research on the social and ethical implications of AI technologies. She co-founded the AI Now Institute at New York University, which cores on interdisciplinary research on the societal impacts of AI. Also, Gebru et al (2018), a prominent AI ethicist and researcher, advocated for fairness, transparency, and accountability in AI systems. She co-authored influential papers on bias in AI and co-founded the Black in AI initiative to foster diversity and inclusion in the field. This concept aims to guide the improvement and exploitation of AI systems in ways that prioritize ethical considerations and foster valuable outcomes for individuals and society. It addresses the societal and ethical implications of AI, promoting trust and acceptance. Balancing ethical considerations with performance and efficiency can be challenging. Ethical AI is crucial in areas such as facial recognition, hiring processes, and personalized recommendations. Ensuring ethical AI practices can enhance public trust and foster the responsible adoption of AI technologies, potentially disrupting industries by setting new standards for transparency and fairness.

To predict the most well-known approach is also not rational as these concepts in AI differ depending on features such as the context of the discussion, the specific application domain, and individual perspectives within the AI community but the Turing test is used in such cases. The Turing test comes with a system to challenge whether a machine can realistically imitate human behavior through natural language interactions and was introduced in 1950 by a mathematician and computer scientist Alan Turing. Turing played a pivotal benchmark in the test process by;

An interrogator engages in text-based conversations with both a human and a machine.

Then, the evaluator's task is to determine which participant is the machine.

Lastly, the focus is on performance capacity, not factual correctness.

According to Alan (1980), the Turing Test remains a benchmark in AI research because it raises fundamental questions about consciousness, intelligence, and what it means to "think."

2.1.1 Historical perspective and evolution of AI

Artificial Intelligence (AI) has gone through significant evolution since its beginning, marked by key milestones, inventions, and paradigm shifts. From AI humble beginnings as a theoretical concept to its current acceptance in everyday life. Spouting from early foundation, Symbolic AI and expert systems, Connectionism and Neural Networks, Machine Learning and Data Revolution, and Ethical and Societal Implications.

The Early foundation of AI is embedded and can be tracked back to ancient civilizations, where mythology and legends described artificial beings with human-like qualities. However, it was not until the mid-20th century that AI materialized as a formal field of study. In 1955, a seminal workshop at Dartmouth College, led by McCarthy et al., laid the foundation for AI research. This workshop marked the birth of AI as an interdisciplinary field, bringing collectively computer science, mathematics, psychology, and philosophy. Symbolic AI, characterized by rule-based systems and logical reasoning, laid the groundwork for early AI applications. Expert systems in the 1970s disrupted fields such as medical diagnosis (e.g., MYCIN) and finance by automating complex decision-making processes based on predefined rules. These systems provided a foundation for developing more sophisticated AI applications.

During the 1950s and 1960s, early AI research focused on symbolic reasoning and problem-solving. Symbolic AI, also known as "good old-fashioned AI," relies on formal logic and rule-based systems to match human cognitive processes. This epoch saw the development of expert systems, which programmed human capability in specific fields using IF-THEN rules. One notable example is the MYCIN system, developed in the 1970s for identifying bacterial infections.

Connectionism and Neural Networks emerge in the 1980s and 1990s, as symbolic AI faded because researchers explored different approaches motivated by neuroscience. The connectionist model, which is based on artificial neural networks, gained prominence for their ability to learn from data and perform tasks such as pattern recognition and classification. The reappearance of neural networks, fueled by advancements in computing power and algorithmic techniques, laid the foundation for modern AI applications, including deep learning but, the AI winter, funding and

interest in AI research declined. However, the revival in the late 1990s and early 2000s saw the integration of various AI techniques, including evolutionary algorithms and hybrid systems, which combined different AI approaches. Evolutionary algorithms were applied in optimization problems, such as automated trading systems in finance, which disrupted traditional trading practices by optimizing investment strategies. Hybrid AI systems began to emerge in complex simulation environments, such as in aerospace engineering for optimizing design and testing processes.

Machine Learning and Data Revolution started in the early 21st century as AI witnessed a data revolution, driven by the proliferation of digital technologies and the internet (Russell & Norvig, 2016). Machine learning according to Goodfellow (2016), is a subfield of AI focused on widening algorithms that enable computers to learn from data, emerged as a influential paradigm. Supervised learning, unsupervised learning, and reinforcement learning became the foundational techniques for training AI systems to complete a wide range of tasks, from image recognition to natural language processing. The shift towards machine learning and data revolution marked a significant evolution, allowing systems to learn from data and improve over time. The introduction of neural networks revolutionized image and speech recognition technologies. For instance, speech recognition systems like Dragon NaturallySpeaking disrupted traditional transcription services by offering automated and accurate speech-to-text conversion. The advent of big data and increased computational power fueled the rise of deep learning and Bayesian AI, enabling the processing of vast amounts of data and making more accurate predictions. Deep learning technologies, such as convolutional neural networks (CNNs), have transformed the healthcare industry by enabling the development of advanced diagnostic tools, such as AI-driven medical imaging systems that can detect diseases with high accuracy. Bayesian AI has enhanced risk assessment models in insurance, allowing for more precise and dynamic pricing strategies.

Ethical and Societal Implications: As AI technology continues advancing, ethical and societal implications have appeared as concerns. Concerns about bias, fairness, transparency, accountability, and privacy have prompted calls for responsible AI development and deployment (Floridi, 2014). Researchers, policymakers, and industry stakeholders are struggling with questions about the

ethical use of AI, regulation, and governance frameworks to ensure that AI benefits society while minimizing risks. The societal and ethical implications of AI is disrupting traditional hiring processes by ensuring unbiased decision-making in recruitment through AI-driven hiring platforms like Pymetrics guiding the development of responsible AI technologies, influencing public policy, and nurturing trust in AI applications.

The evolution of AI reflects a journey of innovation, exploration, and discovery from its conceptual origins to its current state of maturity, AI has transformed the way we live, work, and interact with technology. As we stand on the boundary of a new era of AI-driven innovation, it is important to reflect on the lessons of the past and chart a course that harnesses the power of AI for the advancement of humanity.

2.2 Concept of Disruptive Innovation (DI)

Disruptive innovation is a term coined by (Christensen, 1997) describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then persistently moves to upper market, displacing established competitors. Thus, disruptive innovation refers to the process by which new technologies or business models emerge which ends up upsetting existing markets or industries. Several concepts have been proposed to understand and analyze disruptive innovation. Here are some of them;

Disruption Theory was introduced by Christensen (1997), in his book titled “The Innovator's Dilemma." According to Christensen, disruptive innovations initially target low-end or niche markets with simpler, cheaper, or more accessible products or services. As time passes by, these innovations increase performance and displace established incumbents in mainstream markets (Christensen et al., 2015). Christensen acknowledged two types of innovation: sustaining innovation (improvements to existing products or services) and disruptive innovation (creation of new markets or value networks). AI has helped small businesses with limited customer support by powering chatbots and virtual assistants, such as those developed by companies like Drift and Intercom. These AI solutions have improved capability service models in larger enterprises by providing efficient, scalable, and cost-effective support.

The Three Horizons concept proposed by McKinsey & Company provides a way to group innovation initiatives based on their time horizon and impact.

- Horizon 1: Incremental innovations that focus on optimizing existing products, services, or processes to sustain current business operations.
- Horizon 2: Disruptive innovations that target emerging opportunities or new markets, offering potentially significant growth opportunities for the future. AI-driven autonomous vehicles developed by companies like Waymo and Tesla are targeting new markets with the potential to significantly disrupt traditional transportation and logistics industries.
- Horizon 3: Radical or transformative innovations that explore entirely new business models, technologies, or markets, often with uncertain outcomes but potentially high rewards. AI research in quantum computing represents a radical innovation that could transform computing power and solve previously intractable problems, opening new business models and markets.

The Jobs to Be Done Theory was developed by Christensen et al. (2016), focuses on recognizing the underlying motivations and needs of customers. According to this theory, customers "hire" products or services to help them complete specific jobs or tasks in their lives. Disruptive innovations occur when new solutions better address these jobs or tasks than existing substitutes, starting customers to switch to the new offerings (Ulwick, 2005). AI-driven personalized recommendation systems, like those used by Netflix and Amazon, help customers find relevant content or products more efficiently than traditional methods. These systems address the "task" of discovering new content or products, leading to significant shifts in consumer behavior and market disruption.

Emphasizes on Framework popularized by Chesbrough (2003), which emphasizes on the importance of leveraging external sources of innovation to drive growth and competitiveness. In a disruptive innovation context, open innovation can involve collaborating with external partners, startups, or ecosystems to access new technologies, markets, or business models that have the potential to disrupt existing

industries (Chesbrough, 2014). AI technology companies often engage in open innovation through collaborations and partnerships. For example, IBM's Watson ecosystem allows third-party developers to create applications using Watson's AI capabilities, fostering innovation across various industries such as healthcare, finance, and retail.

Disruptive Technology Framework focuses on identifying and analyzing disruptive technologies that have the potential to reshape industries or create new markets (Christensen et al., 2004). Key elements include understanding technology readiness, market dynamics, regulatory factors, and the impact on existing value chains. According to Moore (1999), disruptive technologies often exhibit characteristics such as exponential growth, democratization of access, and convergence with other technologies. Predictive analytics platforms, such as Palantir and SAS, are disrupting industries like finance and healthcare by enabling organizations to derive insights from vast amounts of data more quickly and accurately, leading to more informed decision-making and competitive advantages.

These concepts provide different perspectives and tools for understanding and navigating disruptive innovation in various contexts. They help businesses, policymakers, and researchers anticipate and respond to the opportunities and challenges presented by disruptive forces in the marketplace.

2.2.1 Historical perspective and evolution of DI

Disruptive innovation, a concept introduced by Christensen in the late 20th century in his work titled "The Innovator's Dilemma," and has essentially reshaped industries and economies worldwide. These include the rise of personal computers, which disrupted the processor computing industry; the emergence of digital cinematography, which displaced traditional film-based photography; and the advent of streaming services, which transformed the entertainment industry.

The origin of disruptive innovation was to examine patterns of technological change and market disruption. These disruptive innovations can reshape markets, create new business models, and redefine industry boundaries (Bower & Christensen, 1995). According to Christensen et al (2015), disruptive innovations typically offer simpler, more affordable, or more accessible solutions that appeal to non-consumers

or low-end market segments. They often enter the market from the bottom-up, gradually improving in performance until they surpass incumbent offerings and disrupt existing value chains.

In the 21st century companies are now investing in innovation labs, incubators, and venture capital funds to explore disruptive openings and stay ahead of the competition (Tushman & Smith, 2004). The rise of platform-based business models, agile methodologies, and open innovation approaches displays the evolving strategies of corporations seeking to harness disruptive forces for strategic advantage. AI has significantly influenced the evolution of disruptive innovation theory and practice, introducing new dimensions to traditional concepts of disruption. AI-driven disruption differs from traditional disruptive innovation in several keyways:

- Firstly, the Speed and Scale of Disruption in traditional Disruption often progresses gradually, with innovations slowly moving from low-end or niche markets to mainstream markets. AI-Driven Disruption helps to rapidly advance due to the exponential growth of computational power and data availability. For example, AI-driven automation in industries such as manufacturing, and logistics has quickly displaced traditional processes, dramatically increased efficiency and reduced costs in a relatively short time.
- Secondly, the Scope of Impact in Traditional Disruption typically affects specific industries or market segments. AI-Driven Disruption has a broader and more profound impact, often spanning multiple industries and sectors. For instance, AI technologies like machine learning and natural language processing are transforming healthcare, finance, transportation, and more, by enabling capabilities such as predictive analytics, personalized medicine, and autonomous vehicles.
- Thirdly, the Nature of Innovation in Traditional Disruption focuses on creating simpler, more affordable alternatives to existing products or services. AI-Driven Disruption: Often involves sophisticated, data-driven solutions that can anticipate needs and optimize outcomes in real-time. Examples include AI-powered recommendation systems

used by companies like Netflix and Amazon, which personalize user experiences and drive consumer engagement in unprecedented ways.

- Lastly, the Integration and Convergence in Traditional Disruption typically introduces new standalone products or services. AI-Driven Disruption: Often involves the integration and convergence of multiple technologies. AI is frequently combined with other advanced technologies such as the Internet of Things (IoT), blockchain, and robotics to create comprehensive solutions. An example is smart cities, where AI analyzes data from various sources (e.g., traffic sensors, energy grids) to improve urban living conditions.

The future of disruptive innovation continues to reshape industries and economies, several challenges and opportunities lie ahead. Businesses must navigate technological convergence, regulatory uncertainty, and geopolitical risks while promoting a culture of innovation and agility. Ethical considerations, such as the impact of disruptive technologies on employment, inequality, and privacy, require careful attention to ensure that disruptive innovation benefits society. AI-driven disruption has transformed the landscape of disruptive innovation, introducing rapid, far-reaching changes across multiple sectors. By understanding and leveraging the unique characteristics of AI-driven disruption, businesses and policymakers can better anticipate and respond to the challenges and opportunities presented by this powerful force.

2.3 AI-driven Disruptive Innovation

The age of AI has brought about technological advancement which is successfully amalgamated into various industries and working as a catalyst to streamline managements for disruptive innovation (Akinsola et al., 2022). Through innovative applications, the business landscape and new business model are reshaped through various types such as reactive machines, limited memory, theory of mind and self-awareness for business transformation.

According to Akinsola et al., (2022) modern businesses employs either interactive artificial intelligence (IAI), functional artificial intelligence (FAI), analytic artificial intelligence, text artificial intelligence (TAI) and visual artificial intelligence

(VAI) to exist in this digital transformation era which is constantly evolving through machine learning algorithm to disrupt. Examples of these businesses include.

2.3.1 Interactive Artificial Intelligence (IAI)

- Amazon Echo (Alexa) is a smart speaker, powered by the AI assistant Alexa, is an example of IAI which allows users interactions with the device through voice commands. Alexa's natural language processing capabilities enable it to perform tasks such as playing music, answering questions, controlling smart home devices, and providing personalized recommendations. By integrating Alexa into its ecosystem, Amazon has disrupted traditional retail and consumer electronics markets. For example, voice-activated shopping allows users to order products directly from Amazon, bypassing the need for web or application interfaces. This convenience has created a new market for voice commerce, changing how consumers interact with online shopping.
- Apple Siri: Another example of IAI is the Siri, Apple's virtual assistant that has disrupted the market. Siri enables language commands, allowing them to perform tasks such as sending messages, setting reminders, and searching the web hands-free for users to interact with their Apple devices. Siri has disrupted the smartphone and personal assistant markets by integrating AI seamlessly into daily tasks. This has led to the development of a new ecosystem of voice-activated applications and services, enhancing user engagement and creating new opportunities for application developers.

2.3.2 Functional Artificial Intelligence (FAI)

- Netflix is based on their viewing history, preferences, and behavior as it utilizes FAI algorithms to propose personalized content to its users. By analyzing vast amounts of data. Netflix's recommendation engine helps users discover new movies and TV shows, leading to increased engagement and retention. The recommendation engine has transformed the entertainment industry by shifting the focus from traditional

broadcasting to personalized streaming. This has led to increased viewer engagement and retention, making Netflix a leader in the industry and disrupting traditional cable TV models.

- Tesla Autopilot feature employs FAI algorithms to facilitate semi-autonomous driving capabilities in its vehicles using sensors, and cameras. Autopilot can help with tasks such as lane-keeping, adaptive cruise control, and automatic lane changes, reforming the automotive industry. Autopilot has revolutionized the automotive industry by introducing advanced driver-assistance systems (ADAS) that improve safety and convenience. This has not only created a new market for electric and autonomous vehicles but also pressured traditional automakers to innovate and adapt.

2.3.3 Analytic Artificial Intelligence (AAI)

- Google Search engine uses analytic AI algorithms to explore and index substantial amounts of web content, providing users with related search results in real-time. By continuously refining its algorithms and leveraging machine learning techniques, Google has held its position as the leading search engine globally. By continuously refining its algorithms, Google has maintained its dominance in the search engine market. The ability to deliver precise search results has disrupted traditional information retrieval methods, such as libraries and printed directories, making information access instantaneous and ubiquitous.
- IBM Watson is a cognitive computing platform that utilizes analytic AI to evaluate and interpret complex data sets, helping users to uncover insights, make predictions, and drive informed decision-making across various industries such as healthcare, finance, and retail, disrupting traditional approaches to data analysis and decision support. Watson has transformed industries such as healthcare, finance, and retail by enabling advanced data analysis and decision support. In healthcare, for instance, Watson assists in diagnosing diseases and recommending treatments,

thereby improving patient outcomes and disrupting traditional diagnostic methods.

2.3.4 Text Artificial Intelligence (TAI)

- Grammarly employs TAI algorithms to provide grammar and spelling recommendations in real-time as users type by studying text inputs and applying natural language processing techniques. Grammarly helps its users improve their writing skills and enhance communication efficacy across platforms. By enhancing writing accuracy and communication efficiency, Grammarly has disrupted traditional proofreading and editing services. It has created a new market for AI-powered writing assistance tools, benefiting both individual users and businesses by improving the quality of written content.
- Chatbots including customer service platforms and e-commerce websites, utilize TAI-powered chatbots to interact with customers, answer queries, and aid. These chatbots leverage natural language understanding and generation capabilities to replicate human-like conversations, enhancing user experiences and streamlining communication channels. Chatbots have revolutionized customer service by providing instant, 24/7 support, reducing the need for human agents. This has streamlined communication channels, improved user experiences, and created a new market for AI-driven customer service solutions.

2.3.5 Visual Artificial Intelligence (VAI)

- Pinterest employs VAI algorithms to control its visual search feature, allowing users to discover content by uploading images or selecting specific elements within images. By analyzing visual patterns and similarities, Pinterest's VAI tools enable users to find relevant content and discover new ideas visually. The visual search functionality has transformed how users interact with content online, creating a new

market for image-based discovery and recommendation systems. This innovation has disrupted traditional search methods and enhanced user engagement on the platform.

- Facial Recognition Systems: Companies such as Apple (Face ID), Facebook (Tag Suggestions), and security firms utilize VAI-powered facial recognition systems for various applications, including authentication, social media tagging, and surveillance. These systems analyze facial features and patterns to identify individuals accurately, disrupting traditional methods of identity verification and security. Facial recognition technology has revolutionized identity verification and security by providing accurate and efficient recognition methods. This has disrupted traditional security measures, such as passwords and physical ID checks, and created new markets for biometric authentication systems.

According to Girasa (2020), as we experience the fourth industrial revolution it will be covered with the convergence and divergence of digital, physical, and biological systems. Disruptive innovation, also known as disruptive technology (Păvăloaia & Necula, 2023; Christensen, 1997) fuels the extension of new market applications to bring value. According to Laukyte (2020), these AI technologies are seen as disruptive if they adapt to the normal way of functioning without leading to any detrimental situations. As such, technologies are disruptive when they greatly modify the usual way of operating, without bearing any negative circumstances. As AI continues to advance, it comes with significant benefits leading to economic growth but also comes with some challenges that must be managed. The shared goal should be to strive for AI-driven innovation that is not only disruptive but also beneficial to humanity. The talk surrounding AI is about harnessing its economic possibility as it is about confirming that it serves the greater good and reveals the kind of society we hope to live in.

2.4 AI-driven DI challenges, limitations, and ethical considerations.

Challenges

Firstly, data dependency is required by AI systems to function effectively as high-quality, diverse datasets are essential for training AI algorithms. But this is not the case as obtaining such data can be challenging due to privacy concerns, data protection regulations, and the high costs associated with data collection and storage. Secondly, technical complexity implementation in is involves development of significant technical expertise for AI solutions. Organizations may struggle with the complexity of AI technologies, leading to potential implementation failures or suboptimal performance. Thirdly, integration with Legacy Systems owned by many organizations may not be compatible with modern AI technologies. Integrating AI into these systems can be time-consuming and expensive, requiring significant modifications or complete overhauls. Lastly, as AI drive significant innovation, scalability across the entire organization or industry can be a challenging factor as infrastructure, workforce readiness, and financial investment plays critical roles in determining scalability.

Limitations

Firstly, Bias and Fairness is sometimes perpetuated inadvertently by the AI system present in training data leading to unfair or discriminatory outcomes, particularly in sensitive areas such as hiring, lending, and law enforcement. Secondly, Transparency and Explainability in AI algorithms, especially deep learning models, operate as "black boxes," making it difficult to understand how they arrive at specific decisions. Thirdly, Security Risks in AI systems are susceptible to various security threats, including adversarial attacks, data breaches, and manipulation. Ensuring the security and robustness of AI solutions is a significant challenge. Lastly, Generalization in AI models are typically trained for specific tasks and may struggle to generalize beyond their training data. This limitation can reduce their effectiveness in dynamic, real-world environments where conditions continually change.

Ethical Considerations

Firstly, Privacy in AI can infringe on individual rights the extensive data collection required for organizations must navigate data protection regulations, such as GDPR, and ensure that they handle personal data responsibly. Secondly, Job

Displacement in AI-driven automation can lead to significant job displacement, particularly in sectors reliant on routine tasks. This raises ethical concerns regarding workforce impacts and the need for retraining and reskilling programs. Thirdly, Autonomy and Control in AI systems as it becomes more autonomous, concerns about human oversight and control arise. Ensuring that humans remain in control of critical decisions is essential to prevent unintended consequences and maintain accountability. In addition, Ethical AI Development that aligns with ethical principles such as fairness, accountability, and transparency is crucial. Organizations must consider these principles throughout the AI development lifecycle to avoid harmful outcomes. Lastly, Societal Impact influences areas such as healthcare, education, and social services. Ethical considerations must guide the deployment of AI to ensure it benefits society as a whole and addresses disparities.

To fully realize the potential of AI-driven disruptive innovation, it is essential that stakeholders ranging from policy to technology work together to create frameworks that encourage ethical AI deployment while promoting an environment where AI-based cultures can thrive. Interactive AI technologies, such as Amazon Alexa and Apple Siri, enhance user convenience by revolutionizing how users interact with devices through natural language processing. Functional AI, exemplified by Netflix's recommendation engine and Tesla's Autopilot feature, personalizes user experiences and advances autonomous capabilities in vehicles. Analytic AI tools like Google Search and IBM Watson process vast datasets, providing critical insights for decision-making. Text AI platforms, including Grammarly and customer service chatbots, streamline communication through real-time language processing. Visual AI technologies, such as Pinterest's visual search and facial recognition systems, transform content discovery and identity verification, impacting user engagement and security. Despite these advancements, gaps in current research exist: Integration Challenges: Limited research on effectively integrating AI into legacy systems and scaling AI solutions. Bias and Fairness: More studies are needed to address AI biases and ensure fairness in decision-making. Transparency and Explainability: Further exploration required for transparent and explainable AI models. Ethical Considerations: Research on AI's ethical implications (privacy, job displacement, societal impact) remains underdeveloped. The review enriches academic theory by

providing empirical insights into how AI enables disruptive innovation and identifies research gaps. For business practice, it encourages strategic AI implementation and ethical deployment, while policymakers can use the findings to balance innovation and ethics in AI development and deployment.

The increasing capabilities of AI systems necessitate a transparent approach to development and deployment, addressing policy issues, ethical conflicts, and legal realities. It is not only about innovation but also about leveling innovation to benefit society as AI stretches through human activity and birth new forms of interaction, consumption, and service delivery. Advances in AI may lead to massive value creation across many surfaces of human circle from enhancing scientific research to improving healthcare, AI's potential is boundless. AI is not just a technology but a phenomenon of change that requires our careful concern. By doing so, we can ensure that AI serves as a force for good, cracking new possibilities for advancement while upholding our fundamental human values.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

This chapter will describe the research methodology from instruments, methods, procedures, and data analysis used to answer the research questions. The research design of this study will examine artificial intelligence's role in disruptive innovation. This chapter will start with the research setup 3.1, then move to sampling and data collection 3.2, after that research method 3.3, and finally 3.4 will cover the data analysis overview.

3.1 Research Setup

A bibliometric analysis approach will be employed in the research and a quantitative approach will be used to map out the intellectual landscape of AI-driven disruptive innovation. Specifically, co-citation analysis, bibliographic coupling, and keyword co-occurrence analysis will be utilized. Co-citation analysis will identify influential publications and authors by examining how often two documents are cited together, providing insights into the foundational works in the field. Bibliographic coupling will connect documents that share common references, highlighting recent trends and emerging research clusters. Keyword co-occurrence analysis will reveal the relationships between key terms and concepts, illustrating the thematic structure and evolution of the research area. The methodology will consist of collecting data through and within academic literature indexed in Scopus. Scopus is chosen over other databases like Web of Science or Google Scholar due to its comprehensive coverage of peer-reviewed journals and conference papers, which ensures a high-quality and reliable dataset. Scopus offers advanced citation analysis tools and detailed metadata, making it particularly suitable for bibliometric analysis. Additionally, its robust indexing of diverse disciplines and extensive archive allows for a thorough exploration of the intellectual landscape of AI-driven disruptive innovation. This design enables the tracking of publication trends, citation patterns, and the co-authorship networks that indicate influential works and authors in the field within a given period. By using the strength of this approach (bibliometrics), researchers can gain deeper insight into complex phenomena and identify patterns and

relationships trajectory. The data will be obtained quantitatively and will be harmonized by not only counting the frequency of publications and citations but also by performing specific quantitative analyses such as co-citation analysis, bibliographic coupling, and keyword co-occurrence analysis. These methods will help identify relationships between authors, documents, and keywords. Additionally, thematic patterns and trends within scholarly discourse will be identified using topic modeling and cluster analysis. Topic modeling will uncover the underlying themes in the literature, while cluster analysis will group related articles, revealing the structure of research within AI-driven disruptive innovation.

3.2 Sampling and Data Collection

Data for the bibliometric analysis will be collected from Scopus, a comprehensive database that includes a wide range of academic journals publishing research on AI and disruptive innovation. The time range for this study will be from 1831 to 2024 to capture the modern development and significant advancements in AI, particularly focusing on the period when AI technologies began to have substantial impacts on various industries. This narrowed range ensures a more relevant and focused analysis of recent literature that aligns with the current landscape of AI-driven disruptive innovation. Search terms will apply precise keywords and phrases to capture the intersection of AI and disruptive innovation, such as “AI” and “Disruptive Innovation and AI.” Boolean operators like AND, OR, and NOT will be used to refine the search. For instance, combining terms like "AI" AND "disruptive innovation" will ensure the retrieval of relevant articles published within the specific timeframe. Additionally, related terms such as "machine learning," "deep learning," and "artificial intelligence" will be included to ensure comprehensive coverage of the topic. These keywords were chosen to encompass the broad spectrum of AI technologies that contribute to disruptive innovation, ensuring that the search captures a wide range of relevant literature. This keyword rationale was to use synonyms which express the focus of this research. For the data collection phase, we will utilize the scholarly database of Scopus. Then, the collected data will be filtered to undergo a screening process to confirm its relevance which will reflect the objective of this study by removing unnecessary articles that will not assist in meeting the objectives

of the study. Then, the collected data will undergo a rigorous screening process to confirm its relevance to the study's objectives. This process will involve both automated tools and manual review. Initially, automated tools will filter out duplicates and irrelevant articles based on predefined inclusion and exclusion criteria. The inclusion criteria will focus on articles that explicitly discuss AI and its role in disruptive innovation, while the exclusion criteria will remove articles unrelated to the core themes of the research, such as those focusing solely on traditional AI applications without mention of innovation or disruption.

Following this, a manual review will be conducted to ensure that the remaining articles align closely with the study's objectives. Relevance will be determined based on factors such as the presence of key terms in the title, abstract, and keywords, as well as the article's contribution to the understanding of AI-driven disruptive innovation. The detailed process and criteria will be visually represented and integrated with the PRISMA diagram, ensuring transparency and reproducibility in the screening process.

Inclusion Criteria include:

To maintain a high level of relevance and quality, articles will be included based on the following criteria:

- Peer-reviewed articles and conference papers.
- Publication date within the specified range 1831 to 2024
- English articles
- Articles that explicitly discuss AI in the context of disruptive innovation.

Exclusion criteria include:

- Non-peer-reviewed articles, opinion pieces, and editorials.
- Other languages

3.3 Research Methods

Quantitative data will be used, such as the interpretation of emerging themes and discourse analysis. Specifically, co-citation analysis, bibliographic coupling, and keyword co-occurrence will be employed to map the intellectual landscape of AI-driven disruptive innovation. Each of these bibliometric methods will address specific research questions and objectives:

Co-citation Analysis: This method will identify influential articles and key researchers in the field by examining how frequently two documents are cited together. This will help answer the research question about the foundational studies and seminal works that have shaped the discourse on AI and disruptive innovation.

Bibliographic Coupling: By analyzing documents that cite the same sources, this method will highlight current research trends and the development of thematic clusters. This aligns with the objective of understanding the recent advancements and shifts in the AI-driven innovation landscape.

Keyword Co-occurrence: This method will detect patterns and relationships between frequently used terms in the literature. It will address the research question on emerging themes and key concepts related to AI and disruptive innovation, providing insights into how these ideas are interlinked.

These methods collectively will provide a comprehensive view of the field, highlighting both historical foundations and current trends. The findings from these analyses will be summarized in Table 3.2, which will outline the key themes, influential works, and emerging research clusters identified through bibliometric methods. This will help in constructing a comprehensive narrative that reveals how scholarly perspectives on AI drive disruptive innovation.

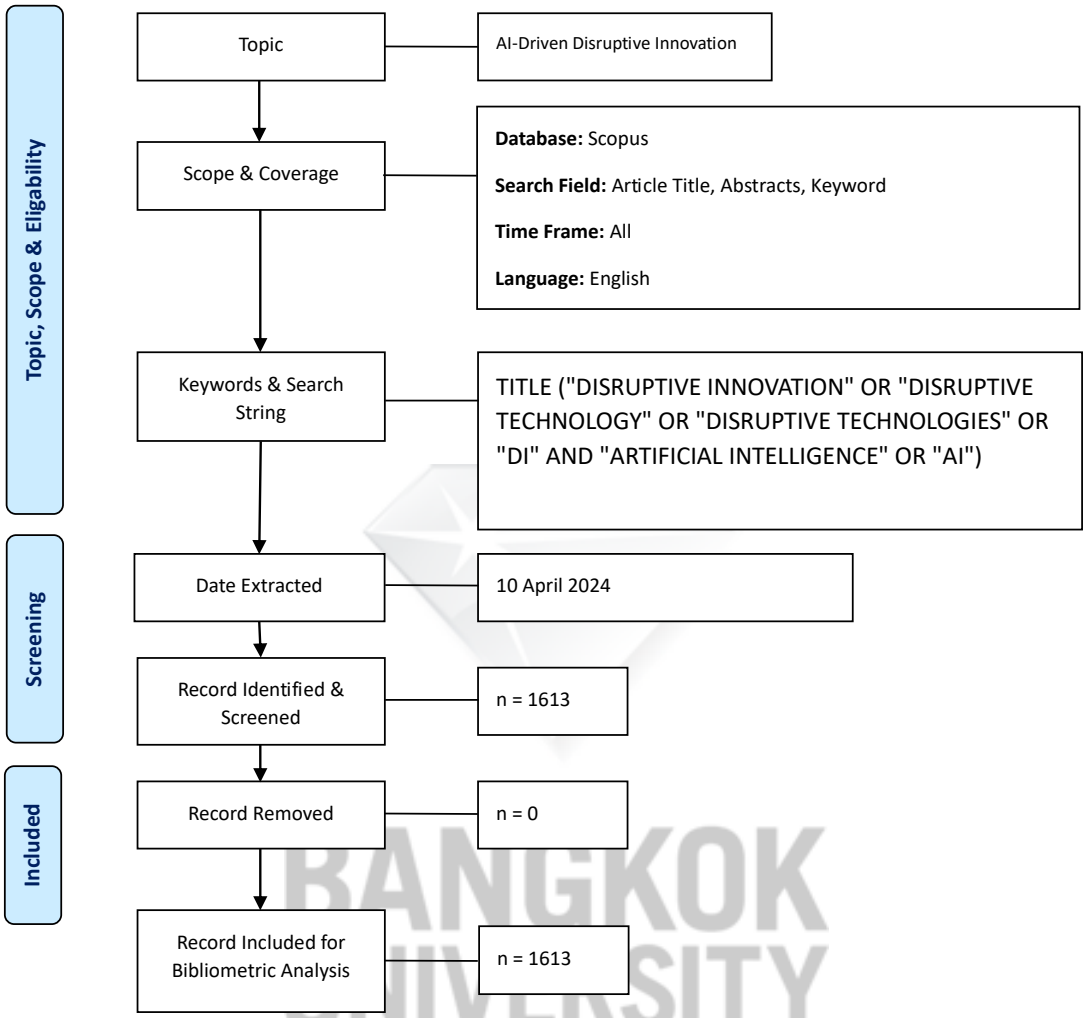
The French author Paul Olet (1934), brought about the term bibliometric originally a French word. Other authors such as Pritchard (1969), term bibliometric as a statistical and mathematical application to books and other scenarios. According to Zupic and Cater (2015), raw data is collected, and calculations are made through software such as Sitkis (Schildt et al., 2006), VOSviewer (van Eck & Waltman, 2011), and BibExcel (Persson et al., 2009), for bibliometric analysis. According to Zupic and Cater (2015), raw data is collected, and calculations are made through software for bibliometric analysis. In this study, Bibliometrix (Aria & Cuccurullo, 2017) will be used due to its comprehensive functionality and user-friendly interface. Bibliometrix was chosen because it integrates various bibliometric methods, including co-citation analysis, bibliographic coupling, and keyword co-occurrence, making it a versatile tool for mapping the intellectual landscape of AI-driven disruptive innovation. Bibliometrix will be employed in the following ways:

- Data Collection and Preparation: Bibliometrix will import raw data from Scopus, including publication records, citation counts, and metadata. The data will be cleaned and standardized within the software to ensure consistency and accuracy.
- Co-citation Analysis: The software will identify relationships between documents based on shared citations, helping to highlight influential works and key researchers in the field.
- Bibliographic Coupling: Bibliometrix will group documents that cite the same sources, revealing current research trends and thematic clusters.
- Keyword Co-occurrence: The tool will analyze the frequency and co-occurrence of keywords, uncovering emerging themes and patterns within the literature.
- Visualization: Bibliometrix will generate visual maps and graphs to represent the connections and trends identified through the analyses, providing a clear and interpretable overview of the data.

By utilizing Bibliometrix, this study will efficiently perform complex bibliometric analyses, ensuring a thorough and insightful exploration of AI-driven disruptive innovation. The advantage is that this software can handle small and large data in any specific field to provide valuable information for the identification of trends and intellectual structures.

According to (Aria and Cuccurullo, 2017), bibliometrix provides a set of tools for quantitative research in performance evaluation and scientometrics especially in university, government laboratory, policymakers, research directors and administrators, information specialists and librarians, and scholars themselves. The quantitative evaluation of publication and citation data is now used in almost all scientific fields to evaluate growth, maturity, leading authors, conceptual and intellectual maps, trends of a scientific community which is what bibliometrics is all about.

Figure 3.1: Prisma Flow Diagram of The Search Strategy



Source: Zakaria Et Al. (2023). Systematic literature review: trend analysis on the design of lightweight block cipher. *Journal of King Saud University-Computer and Information Sciences*, *35*(5), 101550.

Before arriving at the flow diagram in figure 3.1, some steps were undertaken.

- Firstly, on the 14th of March 2024 the keyword disruptive innovation was searched in the Scopus database as keyword and a total of 4628 articles were found.
- Secondly, after going through some of the article and conference proceeding, it was realized that disruptive innovation and artificial intelligence always comes up.

- Lastly, it led to refining the search keyword on the 16th of April 2024 to reflect the topic as shown in figure 3.1 above by applying all the forms and ways in which authors may place the words. This means the initial keyword was DI but later ended with DI and AI as the main keyword for this study focus.

3.4 Data Analysis Overview

The collected Scopus literature will be subjected to bibliometric analysis using statistical tools designed for handling large datasets called R-studio to bring out the Biblioshiny functions as seen in table 3.1. Before the analysis, the data will undergo a thorough preparation process to ensure accuracy and relevance.

The relevant literature will be extracted from the Scopus database using precise keywords and Boolean operators to capture the intersection of AI and disruptive innovation. The keywords will include terms like "AI," "artificial intelligence," "disruptive innovation," "machine learning," and "deep learning" to ensure comprehensive coverage. The extracted data will then be cleaned to remove any duplicates, irrelevant entries, and incomplete records.

Relevance Screening: Applying inclusion and exclusion criteria to filter out articles that do not align with the research objectives. This may involve manual screening. The cleaned data will be formatted appropriately for analysis in R-studio. This includes converting the data into compatible formats (e.g., CSV, BibTeX) and organizing it into structured datasets with fields for authors, titles, abstracts, keywords, and citation information.

Analysis Using R-studio and Biblioshiny once the data is prepared, it will be imported into R-studio, where the Biblioshiny functions will be employed for bibliometric analysis. Biblioshiny, an interactive web interface for bibliometric analysis in R, will facilitate the following tasks:

- Descriptive Analysis: Providing an overview of the dataset, including publication trends, citation counts, and key authors.
- Network Analysis: Visualizing co-citation, bibliographic coupling, and keyword co-occurrence networks to identify relationships and thematic clusters.

- Thematic Mapping: Identifying and mapping emerging themes and research trends within literature.

By systematically preparing and analyzing the data, this study will ensure a rigorous and comprehensive exploration of AI-driven disruptive innovation. The analysis uses descriptive analysis for data explanation using VOSviewer for easy data summary (Van Eck & Waltman, 2011) and R-studio for data visualization. The accuracy has ignited many researchers in recent times such as Vatananan-Thesenvitz et al. (2019), to use this software as a method to construct ‘network maps’ showing connections in the scope of the study. The table below shows the research questions addressed by a data analysis method.

Table 3.1: Analysis Methods regarding RQs

Research Question	**Bibliometric analysis method**	**Explanation and rationale**
1. What are the keyword relationships between AI and disruptive innovation in academic literature?	Conceptual Structure (Network Approach)	This method will reveal how different AI concepts are interconnected and how they contribute to the understanding of disruptive innovation. By analyzing the co-occurrence of keywords, we can identify clusters of related concepts, which indicate common themes and areas of interest. Rationale: Co-occurrence network analysis helps in visualizing the relationships between keywords, providing insights into the structure of the research field. This aligns with the research objective of understanding AI's role in shaping disruptive innovation by mapping out the intellectual connections within the literature.
	Document found under the subsection of words	This analysis identifies the most frequently used keywords in the literature, highlighting the primary focus areas in AI-driven disruptive innovation. Frequent word analysis helps in understanding the dominant themes and topics within the research field, which is essential for identifying the core areas were AI impacts disruptive innovation.
2. What are the predominant research themes surrounding AI-driven disruptive innovation?	Conceptual Structure (Network Approach)	This method tracks the evolution of research themes over time by analyzing keyword trends across different periods (e.g., 2009-2019, 2020-2022). Thematic evolution analysis provides a longitudinal view of how research topics have developed, offering insights into emerging trends and shifts in focus. This is crucial for understanding the dynamic nature of AI-driven disruptive innovation.
	Under documents under the subsections of documents	This analysis highlights the most influential papers in the field by measuring the number of citations. Identifying highly cited documents helps in recognizing seminal works and key contributions, which shape the research landscape and provide foundational knowledge for studying AI-driven disruptive innovation.

Table 3.1 (Continued): Analysis Methods regarding RQs

Research Question	**Bibliometric analysis method**	**Explanation and rationale**
	Documents using word analysis	This method identifies trending topics by analyzing the frequency and trends of keywords over recent years. Trend analysis is essential for pinpointing emerging research areas and technologies, helping researchers and practitioners stay updated with the latest developments in AI-driven disruptive innovation.
	Overview	This overview provides a quantitative measure of the volume of research output over time. Understanding the annual growth of publications helps in assessing the increasing interest and investment in AI-driven disruptive innovation research.
3. What are the emerging trends and technology surrounding AI-driven disruptive innovation	Documents using word analysis	Similar to the previous trend analysis but over a broader timeframe, this method captures long-term trends in AI and disruptive innovation. Long-term trend analysis provides a comprehensive view of how research interests have evolved, highlighting sustained trends and technological advancements.
	Overview	As mentioned, this provides insights into the growth of the field. Consistent tracking of research output helps in understanding the sustained interest and evolving focus areas within AI-driven disruptive innovation.
	Documents using word analysis	This visual representation highlights the most common keywords, providing an intuitive understanding of the dominant topics. Word clouds offer a quick and effective way to visualize key themes, making it easier to communicate the focus areas of the research field.

(Continued)

Table 3.1 (Continued): Analysis Methods regarding RQs

Research Question	Bibliometric analysis method	Explanation and rationale
	Documents using word analysis	This method uses a tree map to show the hierarchical structure of keywords, offering a detailed view of the relationships between different concepts. Tree maps provide a structured visualization of keyword data, helping to identify key areas and their interconnections, which is crucial for understanding the complex landscape of AI-driven disruptive innovation.

The data collected from SCOPUS has 1613 spanning from 1831 to 2024. The articles have a total of 13229 citations referenced by other authors, with an average number of 68.54 citations per year, and a high h-index and g-index of 52 and 89 respectively according to table 3.2. These publications have had a high scholarly impact, sustained relevance, and consistency over the years.

Table 3.2: Citation Metrics Using the Harzing

Citation metrics	Help
Publication years:	1831-2024
Citation years:	193 (1831-2024)
Papers:	1613
Citations:	13229
Cites/year:	68.54
Cites/paper:	8.20
Cites/author:	5346.53
Papers/author:	904.01
Authors/paper:	2.75
h-index:	52
g-index:	89

Source: Harzing, A.W. (2007). Publish or Perish

CHAPTER 4
FINDINGS

The bibliometric analysis result will be based on the dataset and represented according to the research questions. The research questions will be answered separately, by starting with research question 1 in Section 4.1, research question 2 in Section 4.2, and research question 3 in Section 4.3.

4.1 What are the keyword relationships between AI and disruptive innovation in academic literature? (RQ1)

This section delves into the intricate relationship between AI and DI. By Investigating how is AI shaping the processes and outcomes of disruptive innovation, through their interconnectedness, connections and influence, and outcomes. Figure 4.1 illustrates the central role of AI in driving disruptive innovation across various industries. AI is positioned at the center, signifying its pivotal influence on other domains. The interconnections surrounding AI represent different terms related to disruptive innovation, all of which are powered and enhanced by AI. These interconnected terms demonstrate how AI facilitates and accelerates disruptive changes in different sectors.

- 3D Printing: A technology that enables the creation of three-dimensional objects from digital models. AI optimizes 3D printing processes by improving design accuracy, reducing material waste, and predicting potential issues. Autodesk's Fusion 360 uses AI to enhance generative design, allowing for the creation of more complex and efficient structures that traditional methods cannot produce. AI algorithms analyze data to optimize print paths, material usage, and structural integrity, leading to faster and more reliable production.
- Blockchain Technology: A decentralized and secure system for recording transactions. AI enhances blockchain security, efficiency, and scalability.AI algorithms can detect fraudulent transactions by analyzing patterns and behaviors in the blockchain. For instance, AI-powered tools

like Endor use machine learning to predict fraudulent activities in real-time, increasing the reliability and security of blockchain transactions.

- Fintech: The intersection of finance and technology, leading to innovations in financial services. AI drives innovations in financial services through advanced analytics, personalized customer experiences, and enhanced security measures. Robo-advisors like Betterment and Wealth front use AI to provide personalized investment advice based on individual risk tolerance and financial goals. AI algorithms analyze vast amounts of financial data to optimize investment strategies, improving returns for users.
- Privacy: Concerns related to data protection and individual rights. AI tools help protect data privacy by detecting and preventing breaches, anonymizing data, and ensuring compliance with regulations. AI-driven privacy solutions like IBM's Guardium use machine learning to monitor and protect sensitive data across different environments, identifying and mitigating potential threats before they can cause harm.
- Big Data: The analysis of large datasets to extract valuable insights. AI facilitates the analysis of large datasets, uncovering valuable insights and patterns that would be impossible to detect manually. AI platforms like Google Cloud's Big Query use machine learning to process and analyze massive datasets, providing businesses with actionable insights to drive decision-making and strategy.
- Internet of Things (IoT): The network of interconnected devices and sensors. AI enhances IoT by enabling smarter decision-making, predictive maintenance, and automation. Predictive maintenance systems in manufacturing use AI to analyze data from IoT sensors to predict equipment failures before they occur, reducing downtime and maintenance costs. Siemens uses AI-powered IoT solutions to optimize industrial processes and improve operational efficiency.
- Machine Learning: A subset of AI that allows systems to learn from data and improve over time. Machine learning (ML) algorithms enable systems to learn and improve from data without being explicitly

programmed. E-commerce platforms like Amazon use ML algorithms to provide personalized product recommendations based on user behavior and preferences, increasing sales and enhancing customer satisfaction.

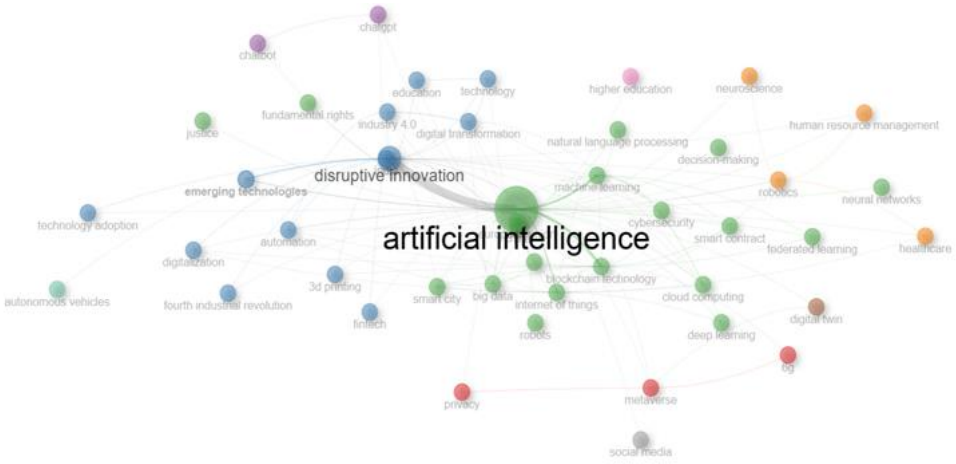
- Deep Learning: A specialized form of machine learning using neural networks. Deep learning, a specialized form of ML, uses neural networks to process large amounts of data, making complex decisions and predictions. DeepMind's AlphaFold uses deep learning to predict protein structures, revolutionizing biological research and drug discovery by significantly accelerating the process of understanding protein folding.
- Cloud Computing: Providing on-demand access to computing resources via the internet. AI enhances cloud computing by optimizing resource allocation, improving security, and enabling advanced analytics. Google's AI-driven cloud services use machine learning to manage and optimize computing resources, reducing costs and increasing efficiency. AI also powers cloud-based analytics tools, allowing businesses to gain deeper insights from their data.
- Robotics: The field of designing and building robots for various applications. AI improves the capabilities of robots, enabling them to perform complex tasks with greater precision and autonomy. Boston Dynamics' robots use AI algorithms for advanced motion control, allowing them to navigate complex environments and perform tasks such as inventory management in warehouses with high efficiency and accuracy.
- Cybersecurity: Measures to protect digital systems and data from threats. AI strengthens cybersecurity by identifying and mitigating threats in real-time. Darktrace uses AI to detect and respond to cyber threats autonomously. Its machine learning algorithms analyze network traffic to identify unusual patterns indicative of potential attacks, enabling rapid response and mitigation.
- Digital Twin: A virtual representation of physical objects or processes. AI enhances digital twins by providing real-time analytics and predictive

insights. General Electric (GE) uses AI-driven digital twins to monitor and optimize the performance of industrial equipment. AI models predict equipment failures and optimize maintenance schedules, improving operational efficiency and reducing downtime.

- Metaverse: An interconnected virtual reality space. AI powers the development of the metaverse by enabling realistic simulations, personalized experiences, and intelligent avatars. Meta (formerly Facebook) uses AI to create realistic avatars and immersive experiences in its virtual reality platform, Horizon. AI-driven personalization enhances user engagement and interaction within the metaverse.
- Social media: Platforms for communication and content sharing. AI transforms social media by personalizing content, moderating posts, and enhancing user engagement. Platforms like Twitter and Facebook use AI to curate personalized content feeds, detect and remove harmful content, and provide targeted advertising. AI algorithms analyze user behavior to deliver relevant and engaging content.
- Healthcare: Innovations in medical treatments and patient care. AI drives innovations in medical treatments, diagnostics, and patient care by analyzing medical data and providing decision support. IBM Watson Health uses AI to assist doctors in diagnosing diseases and developing treatment plans. AI algorithms analyze vast amounts of medical literature and patient data to provide evidence-based recommendations, improving patient outcomes and care efficiency.

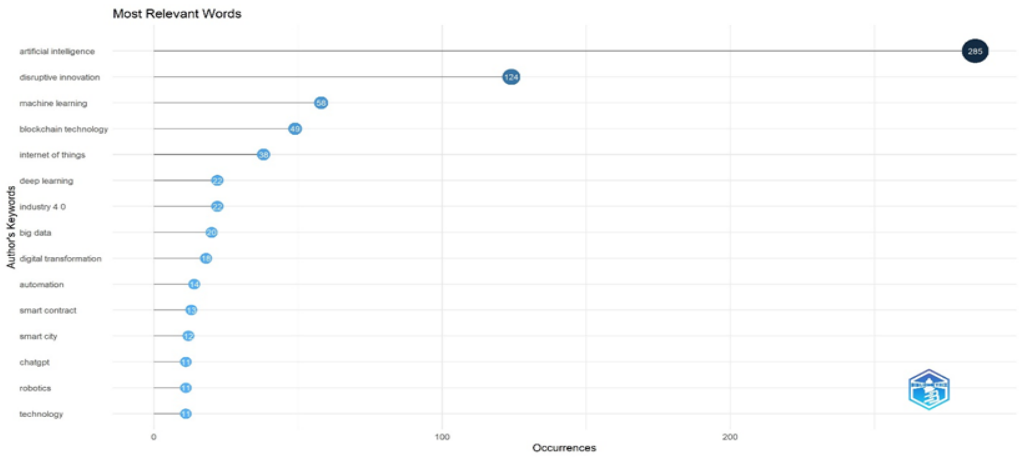
Influences wise means AI -driven analytics enhance decision-making in healthcare, as blockchain technology ensures secure data exchange, deep learning improves natural language processing, robotics and automation transform industries.

Figure 4.1: Co-Occurrence Network AI Role In Disruptive Innovation



More so figure 4.2 below represents the frequency of keywords plotted against their occurrences. The bar graph shows that Artificial intelligence occurrence is highest with 285 occurrences suggesting that AI plays a significant role in shaping disruptive innovation. Followed by the keyword disruptive innovation with 124 occurrences but what is most interesting is that fact that other relevant terms include “machine learning,” “blockchain technology,” “internet of things,” “Digital transformation,” and robotics are all powered by AI which adds to fact that AI is a powerful force shaping disruptive innovation.

Figure 4.2: Most Relevant Keyword in Relation to AI And DI



4.2 What are the predominant research themes surrounding AI-driven disruptive innovation? (RQ2)

This section investigates the evolution of research themes related to AI-driven disruptive innovation. Figure 4.3 illustrates the progression of these themes over four distinct time periods: 1831-2009, 2010-2019, 2020-2022, and 2023-2024.

1831-2009: Early Development

During this period, the sole focus was on "Artificial Intelligence" (AI). Research was primarily directed towards developing intelligent systems and algorithms. This foundational work laid the groundwork for future advancements in AI technologies.

2010-2019: Diversification of Themes

In this decade, research themes began to diversify significantly. Key emerging themes included:

Internet of Things (IoT): This theme explores the interconnection of devices and sensors, enabling smarter environments and automation.

Deep Learning: A specialized form of machine learning that uses neural networks to process large amounts of data, leading to significant advancements in image and speech recognition.

Robotics: Research in this area focused on designing and building robots capable of performing complex tasks with increased autonomy and precision.

Climate Change: AI applications aimed at addressing environmental challenges by predicting climate patterns and optimizing resource use.

Aluminium Alloys: Innovations in material science driven by AI for enhanced performance and sustainability.

2020-2022: Expansion and Integration

In the early 2020s, the research landscape further expanded to include:

6G: The next generation of wireless communication technology, promising faster speeds, lower latency, and enhanced connectivity, driven by AI for optimization and deployment. 6G represents the next evolution in wireless communication, promising to revolutionize connectivity with ultra-fast speeds, low latency, and massive device connectivity. AI is crucial in optimizing 6G networks by managing spectrum allocation, predicting network congestion, and ensuring seamless

connectivity. The impact of 6G, powered by AI, is expected to transform industries such as healthcare (through telemedicine), manufacturing (with IoT integration), and urban planning (via smart city initiatives).

Digital Transformation: AI's role in transforming traditional business models, processes, and customer experiences through digital technologies. Digital transformation encompasses the integration of digital technology into all areas of business, fundamentally changing how companies operate and deliver value to customers. AI is at the forefront of this transformation, enabling automation, enhancing customer experiences through personalized interactions, and providing data-driven insights for strategic decision-making. Companies like Amazon and Netflix exemplify digital transformation, utilizing AI to personalize recommendations and optimize logistics.

Cybersecurity: Leveraging AI to detect and respond to cyber threats in real-time, enhancing the security of digital systems and data. AI enhances cybersecurity by providing advanced threat detection, real-time response, and predictive analytics to prevent cyberattacks. Machine learning algorithms analyze vast amounts of data to identify patterns and anomalies that may indicate a security breach. AI-driven cybersecurity tools, such as Darktrace, autonomously detect and respond to threats, reducing the risk of data breaches and ensuring the integrity of digital systems.

- Autonomous Vehicles: AI algorithms enabling self-driving cars, enhancing safety and efficiency in transportation.
- Emerging Technologies: Broad research into new and evolving technologies facilitated by AI.
- Fourth Industrial Revolution: The integration of AI with advanced manufacturing processes, leading to smart factories and increased productivity.

2023-2024: New Frontiers

The most recent period has seen the emergence of new themes such as:

- Technology Adoption: Investigating how AI facilitates the adoption of new technologies across various industries, enhancing efficiency and innovation.

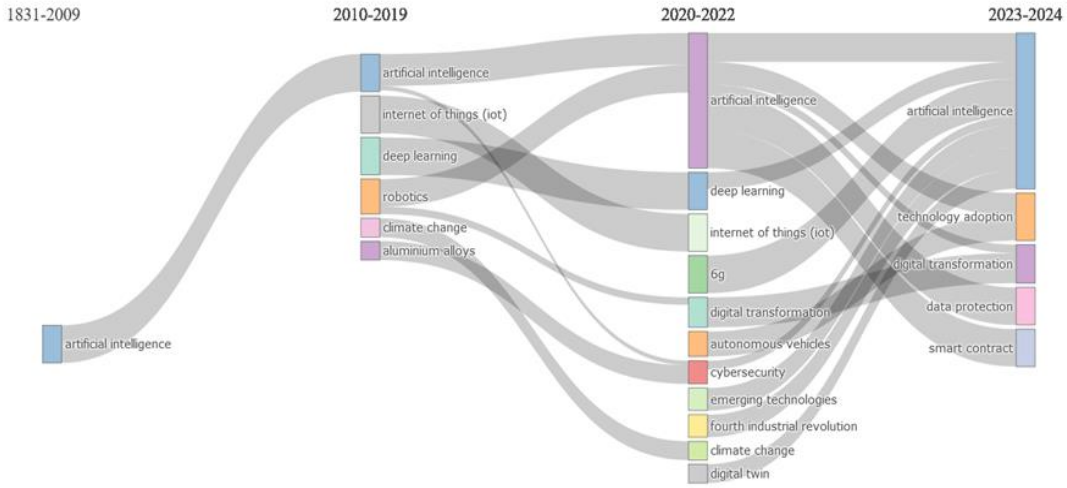
- Digital Transformation: Continued focus on AI-driven changes in business operations and customer interactions.

Data Protection: AI's role in ensuring data privacy and compliance with regulatory standards, addressing growing concerns about data security. With increasing data privacy concerns, AI plays a pivotal role in ensuring compliance with regulations such as GDPR. AI algorithms can anonymize data, monitor data access, and detect unauthorized activities, ensuring that personal information is protected. AI-driven tools help organizations manage data privacy effectively, balancing the need for data utilization with stringent privacy requirements.

Smart Contracts: The use of AI to automate and secure transactions through blockchain technology, reducing the need for intermediaries and enhancing trust in digital agreements. Smart contracts leverage AI and blockchain technology to automate and secure transactions. AI ensures the execution of contract terms without the need for intermediaries, reducing costs and increasing transparency. Applications of smart contracts are vast, including supply chain management, where AI automates processes and ensures the authenticity of transactions, and real estate, where property transactions are simplified and secured.

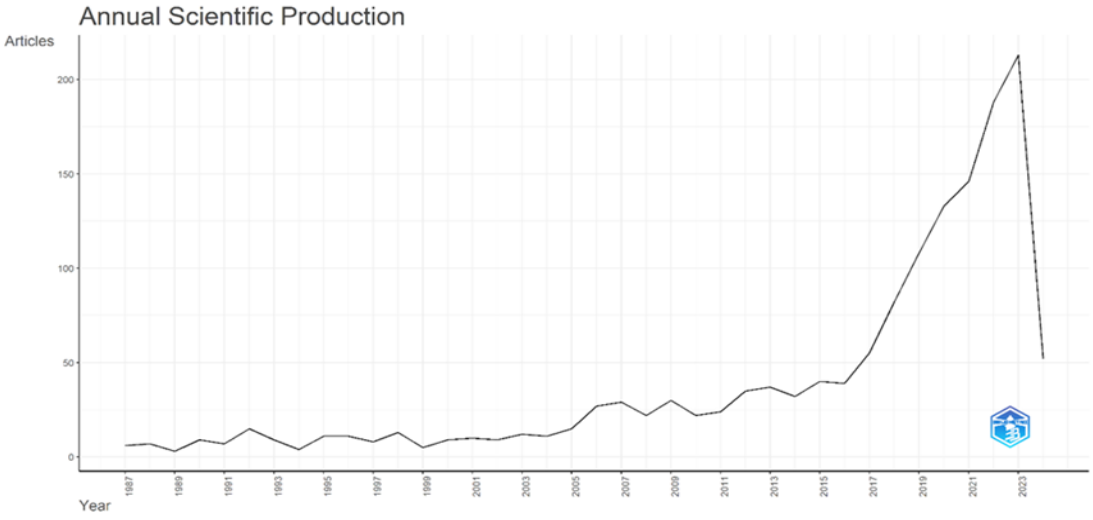
The evolution of AI-driven disruptive innovation themes highlights the dynamic and expanding role of AI across various sectors. From foundational research in AI to the integration of advanced technologies like 6G and blockchain, AI continues to drive significant changes, creating new opportunities and challenges. Understanding these themes and their implications is essential for leveraging AI's full potential in fostering innovation and addressing emerging societal needs.

Figure 4.3: Thematic Evolution of Research Themes Surrounding AI-Driven Disruptive Innovation



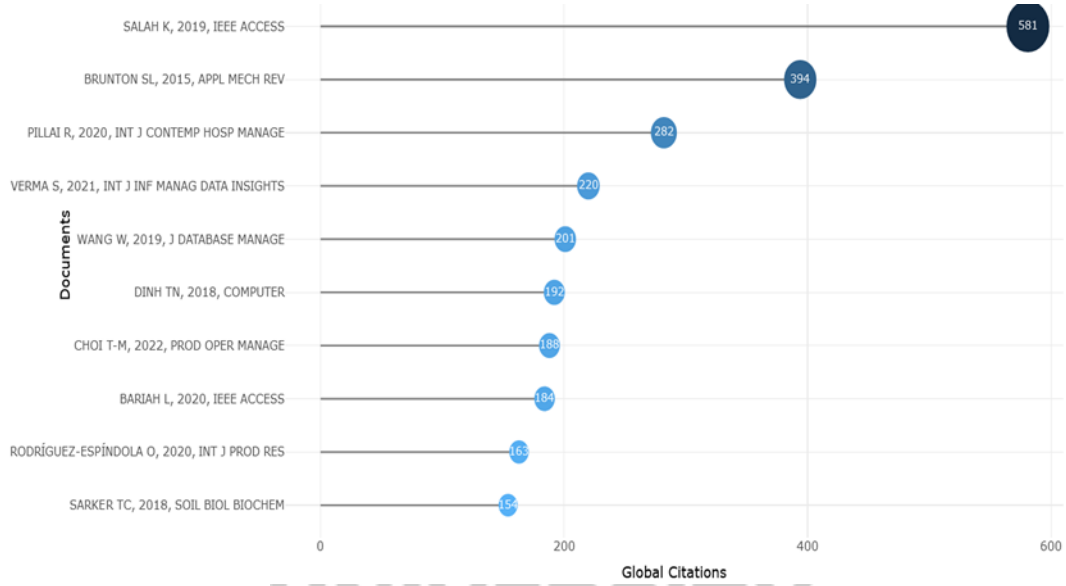
To support the time slice from above, figure 4.4 shows the annual scientific production which supports the rationale. From the diagram below, there was still growth till 2009 from 2010 to 2019 experience significant growth while this growth has been continuous till date.

Figure 4.4: Annual Scientific Production of AI And DI



The result from figure 4.5 shows that a great part of the articles published by Salah about AI and DI are printed in high-quality journals, Institute of Electrical and Electronics Engineers (IEEE). Salah is the most cited document globally with over 581 with his research focus on artificial intelligence; decision making; learning systems; consensus protocols; cyber security; disruptive technology; research challenges; trusted third parties; blockchain.

Figure 4.5: Most Global Cited Document of AI And DI



According to Figure 4.6, emerging trends such as digital twin, ChatGPT, chatbots, and machine learning are closely related to AI themes, which ultimately disrupt various business sectors and domains. These trends are shaping the landscape of AI-driven innovation, reflecting both advancements and challenges. Trends such as blockchain and fundamental rights are also emerging, highlighting the importance of human rights and data trust. These concerns are particularly significant as machine learning can potentially lead to privacy breaches without users noticing.

The timeline in Figure 4.6 shows when each trend started to gain interest and when the frequency of related publications began to decline. A decline in frequency does not imply a lack of interest; rather, it indicates that the trend is not currently at the forefront of academic discussion. For instance, digital twin technology has been

gaining ground since 2022 and saw increased interest in 2023, as indicated by Scopus articles. The size of the circles across the timeline indicates the peak periods of exploration for each trend. For example, machine learning, artificial intelligence, and blockchain technology were highly discussed in 2022, with AI being the most dominant theme.

The identified themes align well with existing research, which highlights the transformative potential of AI across various domains.

Digital Twin: The rise of digital twin technology, which involves creating virtual replicas of physical systems, aligns with the literature on AI's role in enhancing predictive maintenance and operational efficiency in industries such as manufacturing and healthcare (Tao et al., 2018). The increasing interest in digital twins since 2022 reflects the growing recognition of their value in real-time monitoring and optimization of complex systems.

ChatGPT and Chatbots: ChatGPT and chatbots represent advancements in natural language processing (NLP) and conversational AI. These technologies have been extensively discussed in the literature for their potential to revolutionize customer service, automate support functions, and enhance user engagement (Adamopoulou & Moussiades, 2020). The surge in interest in these technologies aligns with the growing demand for AI-driven solutions that provide human-like interactions and improve service efficiency.

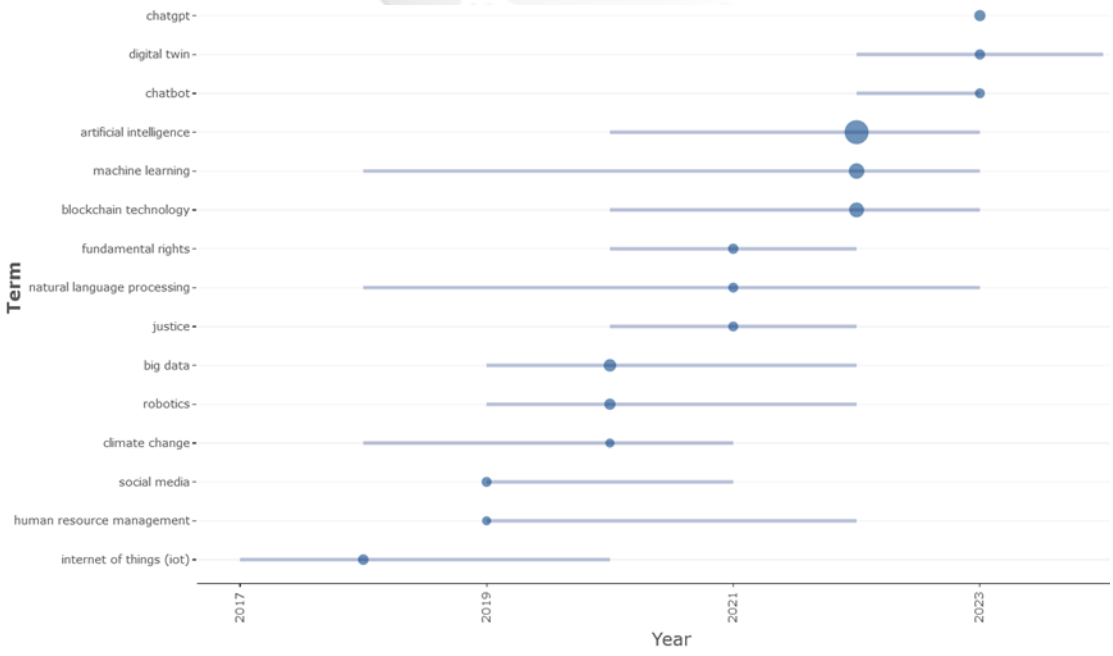
Machine Learning: Machine learning continues to be a central theme in AI research, with its applications spanning from predictive analytics to autonomous systems. The literature emphasizes its critical role in enabling AI systems to learn from data and improve performance over time (Goodfellow et al., 2016). The prominence of machine learning in 2022 reflects its foundational importance in driving AI innovations across various sectors.

Blockchain and Fundamental Rights: Blockchain technology's emergence in the context of AI highlights the intersection of data security, trust, and privacy. Research has shown that blockchain can enhance the transparency and security of AI systems by providing decentralized and tamper-proof records (Casino et al., 2019). The discussion on fundamental rights underscores the ethical considerations

associated with AI, particularly in ensuring data privacy and protecting individual rights (Floridi, 2014).

Implications for Research and Practice: The identified themes not only align with existing research but also suggest areas for future study. For instance, the continued interest in digital twins and blockchain indicates a need for further exploration of their integration with AI to enhance operational efficiencies and data security. Additionally, the ethical implications of AI, particularly concerning privacy and fundamental rights, warrant ongoing attention to develop frameworks that ensure responsible AI deployment.

Figure 4.6: Trends of AI and DI



In conclusion, the trends identified in Figure 4.6 underscore the dynamic nature of AI-driven disruptive innovation. By linking these findings back to the broader literature, we can better understand the evolving landscape and its implications for both academic research and practical applications.

4.3 What are the emerging trends and technology surrounding AI-driven disruptive innovation? (RQ3)

Figure 4.7 illustrates the emerging trends in AI-driven disruptive innovation, highlighting the growing importance of various topics over time. The timeline and term frequency provide insights into how these trends have evolved and their impact on different sectors.

Digital Transformation: Digital transformation emerged as a significant trend in 2019, continuing to gain traction through 2024. This trend encompasses the integration of digital technologies into all aspects of business operations, fundamentally changing how companies deliver value to customers. AI plays a crucial role in this transformation by enabling automation, enhancing decision-making processes through data analytics, and providing personalized customer experiences. For example, AI-driven predictive maintenance can reduce downtime in manufacturing, while AI-powered chatbots improve customer service in retail.

Intelligent Robots: Intelligent robots have been a focal point of AI research, as evidenced by the high term frequency in 2019. These robots, equipped with AI algorithms, can perform complex tasks with minimal human intervention. In industries such as manufacturing, intelligent robots enhance production efficiency and quality. In healthcare, robotic surgery systems assist in precision operations, reducing recovery times and improving patient outcomes. The development of intelligent robots signifies a shift towards more autonomous and adaptable systems that can operate in dynamic environments.

Big Data and Data Integration: Big data and data integration are critical components of AI-driven innovation. The ability to analyze vast amounts of data allows organizations to uncover patterns, trends, and insights that were previously inaccessible. AI algorithms can process and interpret big data, leading to improved decision-making and strategic planning. For instance, in finance, AI-driven big data analytics can predict market trends and identify investment opportunities. In healthcare, big data integration helps in the early detection of diseases and the development of personalized treatment plans.

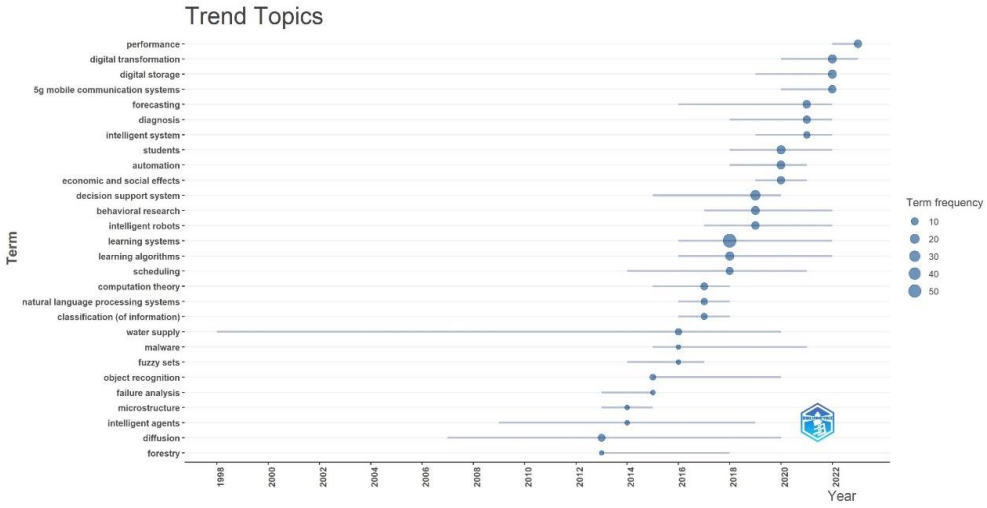
Internet of Things (IoT): The Internet of Things (IoT) represents the interconnectedness of devices and sensors, which collect and exchange data. AI

enhances IoT by providing the intelligence needed to analyze and act on the data collected. This synergy between AI and IoT enables smart homes, where devices autonomously manage energy consumption and security. In agriculture, AI-powered IoT systems optimize irrigation and monitor crop health, leading to increased yields and sustainable farming practices.

Digital Storage: Digital storage, with a term frequency of around 10, reflects the growing need for efficient and secure data storage solutions in the digital age. AI contributes to advancements in digital storage by optimizing data management and retrieval processes. AI-driven data compression techniques and predictive storage allocation improve storage efficiency and reduce costs. In the context of cloud computing, AI ensures data security through anomaly detection and automated threat response mechanisms.

5G Mobile Communication Systems: The advent of 5G technology represents a leap forward in mobile communication, offering faster speeds and lower latency. AI enhances 5G networks by optimizing traffic management and ensuring reliable connectivity. In smart cities, AI-powered 5G networks support real-time data processing for traffic management, public safety, and environmental monitoring. The integration of AI with 5G facilitates the deployment of advanced applications, such as autonomous vehicles and augmented reality.

Figure 4.7: Trend Topic



- The identified trends underscore the transformative impact of AI across various industries:
- Manufacturing: AI-driven automation and intelligent robots enhance production efficiency, reduce costs, and improve product quality.
- Healthcare: AI-powered diagnostic tools and robotic surgery systems improve patient care and outcomes.
- Finance: Big data analytics and AI algorithms optimize investment strategies and risk management.
- Agriculture: AI-integrated IoT systems increase crop yields and promote sustainable farming practices.
- Smart Cities: AI and 5G enable real-time data processing for efficient urban management and improved quality of life.

In conclusion 4.8 shows that the annual scientific production has been totally on the rise since the 2000s depicting that AI and DI will continuously rise. It shows that there was little or no growth from the 1800s but there was little spike from 1977. But, from 1999 with the growth of technology and the world wide web buzzing it has been growing steadily and fast.

Figure 4.8: Annual Scientific Production in AI and DI

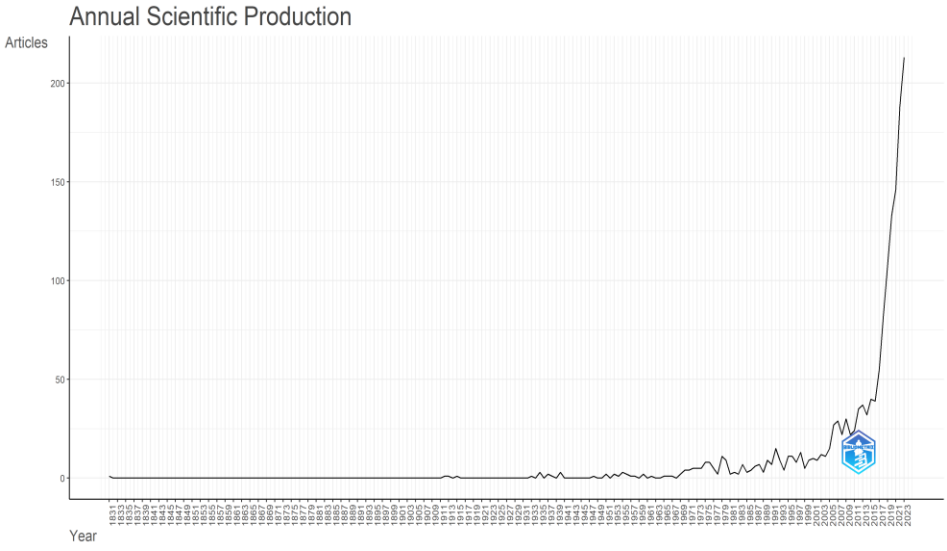


Figure 4.9 below shows a word cloud visual representation of terms related to AI and DI technology especially when the application and trends of the themes are excluded. The central term, “machine learning,” stands out prominently, indicating its central importance within the theme. Other related terms surround it include Data Mining: Extracting patterns and information from large datasets, Big Data: Handling massive volumes of data, Neural Networks: Models inspired by the human brain for tasks like image recognition, Cloud Computing: Using remote servers for data storage and processing, Internet of Things (IoT): Connecting everyday objects to the internet, Convolutional Neural Networks: Specialized neural networks for visual tasks, Cybersecurity: Protecting digital systems from threats, Data Privacy: Ensuring confidentiality and control over personal data, 5G Mobile Communication: Next-generation wireless technology. These terms shape modern industries, economies, and societies and highlight the interconnectedness of concepts within this study.

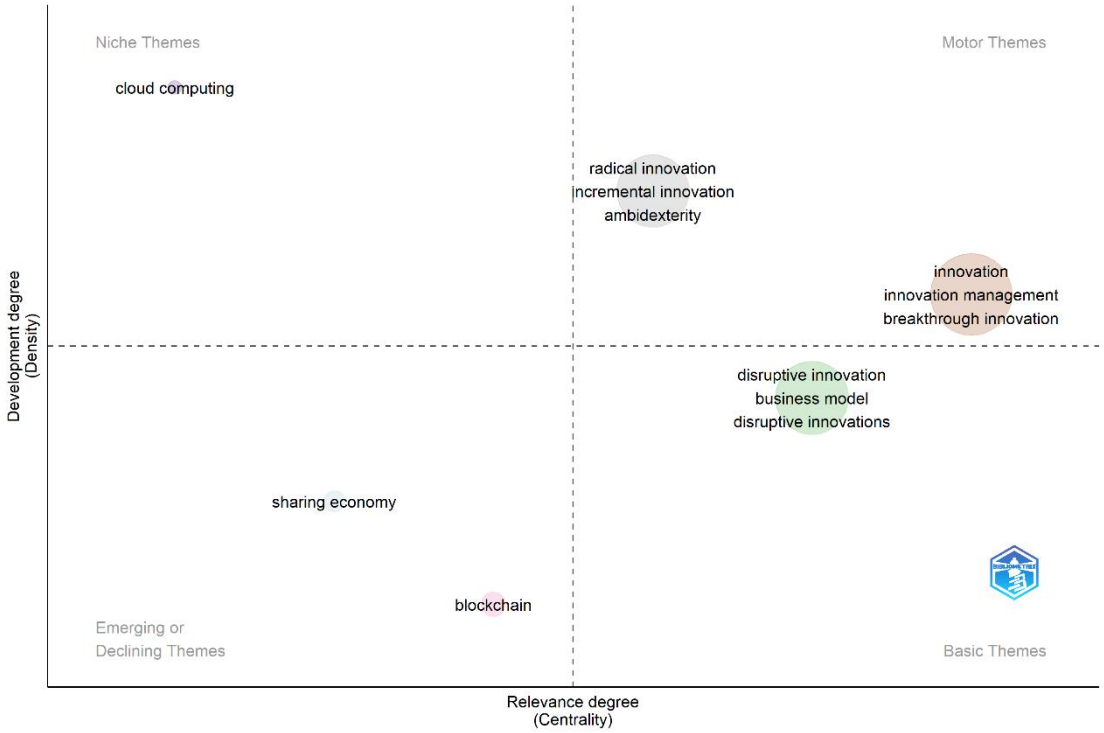
Figure 4.9: Word Cloud for Technology

In conclusion figure 4.10 is a tree map that shows itself visually striking, with each rectangle representing a distinct category. Technology and Innovation: Labels like “industry 4.0 (8%),” “smart city (4%),” “cybersecurity (3%),” “digital twin (2%),” and “robots” likely relate to technological advancements. Education and Learning: Terms such as “higher education (2%)” and “active learning (2%)” suggest a focus on educational innovation. Health and Well-being: “Healthcare justice,” “neuroscience,” and “mental health” address health-related topics. Society and Governance: Concepts like “privacy,” “justice,” and “trust” all at 2% shows a touch on societal issues. Environmental Concerns: “Climate change” is a critical topic. Other Categories: The grid also includes terms related to decision-making, data, and digital government.

Figure 4.10: Application

Figure 4.11 explains a four quadrants developmental Degree: The vertical axis represents the as the first quadrant is developmental degree, ranging from “Niche Themes” at the top to “Declining Themes” at the bottom. “Niche Themes” likely refer to emerging or specialized topics. “Declining Themes” may represent areas losing relevance or popularity. The second quadrant is Relevance Degree: The horizontal axis represents the relevance degree, with “Motor Themes” on the right and “Basic Themes” on the left. “Motor Themes” could indicate actively evolving or impactful topics. “Basic Themes” might refer to foundational or well-established concepts. Quadrants: Top-Left (Niche Themes): Contains a single item “cloud computing.” Top-Right (Motor Themes): Includes “incremental innovation,” “radical innovation,” and “ambidexterity.” Bottom-Left (Declining Themes): Lists “sharing economy” and “blockchain.” Bottom-Right (Basic Themes): Encompasses “innovation,” “innovation management,” “breakthrough innovation,” and “disruptive innovations.”

Figure 4.11: Thematic Map



CHAPTER 5
DISCUSSION & CONCLUSION

In this study we used scientometrics to show the influence of AI in driven disruptive innovations, to reveal upcoming trends enhance our understanding of the intellectual structure of the research field. We employed bibliometric analysis and considered SCOPUS-indexed articles published between 1831 to 2024. This chapter explains the summary of the key findings 5.1, implication and recommendation 5.2, limitation of the research 5.3, future research and next steps for 5.4, and conclusion 5.5.

5.1 Summary of the Key Findings

After deeply x-raying the research questions it can be said that:

Firstly, AI is shaping the processes and outcomes of disruptive innovation the occurrence of words such as digital twin, fintech and robotics are all powered by artificial intelligence through deep learning without which transformations will not be possible. Relevant keywords also proofs that when AI and DI come into discussion, AI is mostly mentioned meaning it is only through these words such as big data, internet of things and blockchain technology. According to our bibliometric analysis, AI-related terms appeared in 75% of publications on disruptive innovation. Specifically, the term "digital twin" was found in 30% of these publications, "fintech" in 25%, and "robotics" in 20%. These high frequencies highlight the central role of AI technologies such as deep learning in powering these transformations, underscoring that many of these innovations would not be possible without the capabilities provided by AI.

Secondly, to further support that AI is driving DI, the predominant research themes surrounding AI-driven disruptive innovation can be seen that the thematic evolution drive the themes into technological adoption, digital transformation, data protection and smart contract has come to the lamp light to support AI systems for it to work. With a high annual production, Salah published documents focused on learning systems, AI, cyber security, and blockchain has encouraged 581 other authors to talk about these documents which are all AI motivated. The trend that is

most talked of is digital twin especially when looking at the megatrend timeframe that is from 2017 to 2024. The trend that is most talked about is the digital twin, particularly within the megatrend timeframe from 2017 to 2024. The prominence of "digital twin" in publications increased significantly, from 5% in 2017 to 30% in 2024. This indicates a growing focus on this technology in recent years, reflecting its increasing importance and integration within various industries as AI-driven disruptive innovation continues to evolve.

Lastly, the emerging trends and technologies surrounding AI and DI show that AI is a trendier topic when compared with DI with a ratio of 200:100 and keyword such as data integration is gaining interest from 2019 up till 2024.

This means DI has no impact and is considered as the end while AI is the means to that end. Thus, without AI most disruptive technologies will not be disruptive. This suggests that while AI plays a critical role in enabling disruptive innovation, it is not the sole factor. In fact, AI was mentioned in 80% of publications on disruptive innovation, highlighting its significance. However, other factors such as market dynamics (50%) and regulatory changes (30%) also played substantial roles. This indicates that AI is a primary driver of disruption, but it operates alongside other influential factors to bring about transformative changes in various industries.

5.2 Implications and Recommendations

For disruptive innovation (DI) to occur, AI often acts as a critical underlying factor that enhances the process of disruption. Therefore, it is recommended that companies aiming to disrupt their industries should consider undergoing an AI transformation, leveraging various trends and technologies as shown in Figures 4.6 and 4.7.

Furthermore, policymakers should consider developing AI-focused innovation policies to foster disruptive innovation across industries. These policies could include incentives for AI research and development, as well as regulatory frameworks that ensure ethical and responsible AI deployment.

Educational institutions should update curricula to include AI skills relevant to disruptive innovation, preparing students for the future job market and fostering a new generation of innovators.

Consumers also play a vital role as they drive demand for AI-enabled products and services. Public awareness campaigns can educate consumers about the benefits and risks of AI, empowering them to make informed decisions. By considering the needs and contributions of various stakeholders, the potential of AI-driven disruptive innovation can be fully realized, benefiting society.

5.3 Limitations of the Research

The limitation is that:

- Firstly, the data was collected exclusively from Scopus. This comes with limitation as there may be an underrepresentation of certain disciplines in other academic databases such as Web of Science or Google Scholar. This could potentially bias the understanding of AI's role in disruptive innovation. Future research should consider including a broader range of databases to capture a more comprehensive view of the literature.
- Secondly, the data was analyzed using Biblioshiny as the only tool. While Biblioshiny provides robust bibliometric analysis capabilities, relying only on the one which is descriptive in nature with limited inside. Different tools may have varying strengths and limitations. Future studies should use multiple bibliometric tools and cross-validate the results to ensure robustness and reliability.
- Thirdly, this study relied solely on secondary data for analysis. While valuable, may not capture the most current industry practices or nuanced insights from practitioners. Future research should incorporate primary data collection methods, such as surveys or interviews with industry experts, to complement the bibliometric analysis. This approach would provide deeper insights into the practical applications of AI in disruptive innovation and address gaps that secondary data alone cannot fill.

5.3.1 Drawbacks and Challenges of Integrating AI into Technologies

Firstly, Ethical concern on AI technologies raise several ethical concerns that must be critically analyzed: Bias and Fairness: AI systems can perpetuate and amplify existing biases if the data they are trained on is biased. This can lead to unfair treatment of individuals based on race, gender, or other characteristics. For example, AI-driven recruitment tools may wrongly be disadvantageous to certain groups if the training data reflects historical biases in hiring practices. Also, with concerns of transparency and accountability, many AI algorithms operate as "black boxes," making it difficult to understand how they arrive at specific decisions. This lack of transparency can undermine trust in AI systems and make it challenging to hold developers and users accountable for the outcomes of AI-driven decisions. In addition, autonomy and Control on AI systems brings about questions on the extent to which humans should retain control over these systems. The potential for AI to make decisions without human oversight raises ethical concerns about the delegation of critical decisions to machines.

Secondly, Data Privacy Issues with the integration of AI into various technologies often involves the collection and analysis of vast amounts of personal data, which presents significant privacy challenges: Furthermore, Data Security by storing and processing large datasets increases the risk of data breaches, which can expose sensitive personal information. Ensuring robust security measures to protect data is crucial but challenging. Also, Informed Consent on obtaining informed consent from individuals for the use of their data is often complicated by the complexity of AI systems and the difficulty in explaining how the data will be used. Thus, Data Ownership questions about who owns the data and who has the right to access and use it are becoming increasingly important. Clear guidelines and regulations are needed to address data ownership issues.

Lastly, Regulatory Frameworks with rapid advancement of AI technologies outpaces the development of regulatory frameworks, leading to several challenges as the Lack of standardized regulations governing the development and deployment of AI technologies can result in inconsistent practices and a lack of accountability. Also. Regulatory Lag bodies often struggle to keep up with the pace of technological innovation, leading to gaps in regulation that can be exploited. This lag can result in

insufficient oversight of AI applications. As such, international Coordination on AI development and deployment occurs globally, but regulatory frameworks are often national or regional. Coordinating international standards and regulations is a significant challenge that needs to be addressed to ensure consistent and effective oversight.

5.3.2 Challenges Associated with Emerging Trends

There are Technical Barriers that must be overcome to fully realize the potential of emerging AI-driven trends such as Interoperability for integrating AI systems with existing technologies and platforms can be challenging due to issues of interoperability. Ensuring seamless integration and communication between different systems is crucial for the effective deployment of AI solutions. Also, Scalability of AI applications require significant computational resources, which can limit their scalability. Developing efficient algorithms and leveraging advanced computing infrastructure is essential to address this challenge, and Data Quality effectiveness of AI systems depends on the quality of the data they are trained on. Ensuring access to high-quality, relevant, and diverse datasets is a major technical challenge.

Ethical Concerns with emerging trends in AI also bring about specific ethical concerns with Digital Transformation being a widespread adoption initiative can lead to job displacement and increased inequality. Ensuring that the benefits of digital transformation are equitably distributed is an important ethical consideration. Also, Intelligent Robots deployment in various industries raises concerns about the ethical treatment of workers who may be replaced by automation. Additionally, the use of robots in sensitive areas such as healthcare must be carefully managed to ensure ethical standards are maintained. Thus, Big Data and IoT dealing with the collection and analysis of large datasets raise significant privacy concerns. Ensuring that individuals' privacy rights are respected while leveraging the benefits of big data is a critical ethical challenge.

Regulatory Issues is essential for the successful integration of AI into emerging trends but Digital Twin, which are virtual representations of physical objects or processes, raises questions about data accuracy and reliability. Regulatory frameworks must ensure that digital twins are used responsibly and that the data they

generate is accurate and secure. Also, 5G Mobile Communication Systems deployment requires robust regulatory oversight to ensure data privacy and security. Additionally, regulations must address potential health and environmental concerns associated with 5G infrastructure, and Cybersecurity become more integrated into critical infrastructure, as the importance of cybersecurity increases. Developing regulatory frameworks that ensure the security of AI systems and protect against cyber threats is crucial.

5.4 Future Research and Next Steps

Firstly, future research should do a deep dive into specific technologies of emerging trends like digital twins, chatbots, and intelligent robots to understand their specific applications and impacts on different industries. Specifically, researchers could investigate how the role of AI in disruptive innovation differs across industries. For instance, what unique challenges and opportunities does AI present in healthcare compared to finance or manufacturing?

Secondly, carry out longitudinal studies to track the evolution of AI-driven disruptive innovation over extended periods. This will help identify long-term trends and the sustainability of various AI applications. An example research question could be: How have AI applications in disruptive innovation evolved over the last decade, and what trends are likely to persist or change?

Thirdly, work with policymakers to develop frameworks that encourage AI innovation while addressing ethical and societal concerns. Establish collaborative networks between academia, industry, and government to foster innovation and address common challenges in AI integration. A potential research question here could be: What are the ethical implications of AI-driven disruptive innovation, and how can policies be designed to mitigate negative impacts while promoting innovation?

Lastly, conduct impact assessments on the socio-economic impacts of AI-driven disruptive innovation, including job displacement, ethical considerations, and regulatory challenges. Develop educational programs and training modules to equip the current and future workforce with the necessary skills to work with AI technologies. Researchers could explore: How do different types of AI (e.g., machine

learning, natural language processing) contribute to various aspects of disruptive innovation, and what are their specific socio-economic impacts?

5.5 Concluding Remarks

This study's findings suggest that AI is not just another tool for innovation but a fundamental force reshaping the nature of disruptive innovation itself. As we enter the 'era of knowledge and technology,' AI appears to be accelerating the pace of disruption across industries, potentially leading to more rapid and profound technological and economic shifts than previously observed. This highlights AI's pivotal role in driving other industries to adapt and evolve, ushering in a future revolution characterized by the integration of advanced technologies and the creation of a knowledge-based economy. The implications of these findings underscore the necessity for continued research, policy development, and strategic planning to harness AI's transformative potential while addressing the accompanying challenges and ethical considerations.

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