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IMPACT OF BLOCK CHAIN, SMART INVENTORY SYSTEM AND AUTOMATION ON SUPPLY CHAIN PERFORMANCE; EMPERICAL EVIDENCE OF RETAIL INDUSTRY OF PAKISTAN

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ABSTRACT

The retail industry in Pakistan is undergoing a profound transformation driven by the integration of cutting-edge technologies into supply chain management practices. This empirical research paper delves into the intricate relationships and collective impact of block chain, smart inventory systems, and automation on supply chain performance within the context of the Retail Industry in Pakistan. Leveraging a robust dataset sourced from diverse retail enterprises across the country, the study employs rigorous empirical methods to provide nuanced insights into the adoption and implications of these technologies.

Through quantitative analyses, including regression modeling and correlation assessments, this research paper not only explores the individual impacts of block chain, smart inventory systems, and automation but also investigates their collective influence on critical supply chain performance metrics. The findings contribute to a nuanced understanding of how the convergence of these technologies shapes the landscape of the retail supply chain in Pakistan.

This research serves as a valuable resource for retailers, policymakers, and industry stakeholders seeking empirical evidence to guide strategic decision-making. By providing a comprehensive empirical foundation, this paper contributes to the burgeoning literature at the intersection of technology adoption and supply chain performance, offering practical insights and recommendations tailored to the specific challenges and opportunities faced by the Retail Industry in Pakistan.

Key Words: Block chain, Smart Inventory system, Automation, Supply chain performance, Retail Industry, etc.

Contents

Chapter 1

INTRODUCTION

1. Background of the study

Pakistan's retail sector is a vibrant, quickly changing business that is essential to the country's economy. It is distinguished by a wide variety of companies, from tiny neighborhood stores to major retail chains, all of which support the industry's growth. The retail industry has undergone notable development in recent times, primarily due to technological advancements that have affected supply chain management practices. In the particular context of Pakistan's retail industry, this study attempts to investigate the impact of three major technology enablers on supply chain performance: automation, smart inventory systems, and block chain.

Retail Supply Chains Using Block chain technology completely transform supply chain management has attracted a lot of attention on a worldwide scale. It runs using a decentralized, tamper-proof ledger system that offers supply chain-wide traceability and transparency. Block chain adoption has potential in Pakistan, where trust issues and inefficient supply chains have previously presented difficulties. According to research done in 2020, supply chains may benefit from increased accountability, less fraud, and transparency thanks to block chain technology (Smith et al., 2020).

Smart Inventory system is to maximize inventory management, smart inventory systems make use of data analytics, Internet of Things (Iota) sensors, and cutting-edge software. Real-time visibility into inventory turnover rates, demand forecasting, and stock levels is provided by these systems. In a market such as Pakistan, where demand variations and the requirement for cost-effective inventory management are critical, this real-time data-driven approach can prove to be especially advantageous. 2021 research demonstrates the potential benefits of smart inventory. Methods to lower carrying costs and increase inventory accuracy (Khan & Rahman, 2021).

Automation can improve operational efficiency and streamline supply chain procedures through the use of robotics, artificial intelligence, and machine learning. In Pakistan's retail industry, where labor-intensive processes are typical, automation can result in lower costs and higher output. Automation solutions may be able to improve operations like order picking, packing, and shipping, according to recent studies published in 2023 (Ali et al., 2023).

1.2 Destination of Variables

1.2.1 Block chain

“Block chain is a decentralized and distributed digital ledger technology that facilitates safe and transparent recording of transactions over a network of computers. Within a blockchain, every transaction is meticulously documented in a block, and these blocks are interconnected in a sequential chain, creating an impervious and unchangeable account of all transactions. The ledger's decentralization ensures that no one institution possesses complete authority over the whole blockchain, therefore bolstering security and fostering confidence. Cryptography is utilized to ensure the security of transactions, while consensus techniques are applied to authenticate and reach a consensus on the state of the blockchain. Block chain technology is primarily linked to the backing of cryptocurrencies such as Bitcoin. However, its use goes beyond digital currencies and encompasses other sectors. It provides solutions for enhancing transparency, traceability, and trust in numerous transactional processes".

Technological advancements have led to the increased sophistication of corporate operations. The process of recording and retrieving data has become more efficient, and blockchain technology has further simplified this chore. Block chain is a decentralized system that records transactions for future reference (Hald & Kinra, 2019). The process of documenting transactions is inherently durable, thereby ensuring the reliability of verification. On a daily basis, the retail business processes hundreds of transactions, making it increasingly challenging to efficiently capture and store them in computer systems due to storage limitations and particular retrieval requirements. Thanks to the implementation of blockchain technology, the process of verification has been significantly simplified and straightforward. This has enhanced the efficiency of the whole supply chain by accelerating the delivery time, which is a fundamental customer need.

1.2.2 Smart Inventory System

“A smart inventory system refers to an advanced and automated approach to managing and monitoring inventory in a streamlined and intelligent manner. Leveraging technologies such as Internet of Things (IoT), data analytics, and real-time tracking, a smart inventory system enables businesses to efficiently track, manage, and optimize their inventory levels. Key features often include automated data collection, sensors, and connectivity to provide real-time insights into stock levels, demand patterns, and other relevant inventory metrics. This technology enhances operational efficiency by minimizing stock outs, reducing carrying costs, and improving overall inventory accuracy. Smart inventory systems are employed across various industries to

modernize and optimize inventory management processes, offering businesses a competitive edge in today's fast-paced and data-driven business environment".

Inventory management is a formidable challenge for any organisation due to the intricate nature of demand forecasting. It also varies from one industry to another. In the retail business, several sorts of goods are available, including convenience, shopping, and luxury items. The demand for these goods fluctuates depending on the spending capacity of the clients. A smart inventory system is necessary in this context. The intelligent inventory system possesses the capability to monitor inventory levels, while also offering scalability, security, and backup provisions. In the retail business, the implementation of a smart inventory system is necessary. One example of this is the use of smart shelves, which enable real-time inventory monitoring (Liu, Wang, Lin, Xie & Zhang, 2020). The advent of remote monitoring has enabled businesses to watch inventory levels in real time, facilitating timely restocking of shelves to satisfy customer demand.

1.2.4 Automation

“Automation refers to the use of technology, machinery, or systems to perform tasks or processes with minimal human intervention. The primary goal of automation is to increase efficiency, accuracy, and productivity while reducing manual labor and the possibility of errors. In various industries and applications, automation can involve the use of robotics, computer systems, software, and control systems to carry out tasks that were traditionally performed by humans. Automation can range from simple, repetitive tasks to complex operations that require sophisticated control systems and artificial intelligence. Examples of automated processes include manufacturing assembly lines, robotic machinery in industrial settings, automated data entry and analysis in business operations, and smart home systems that control household devices. The adoption of automation is driven by the desire to enhance operational efficiency, reduce costs, improve quality, and increase the speed of processes. While automation offers numerous benefits, it also raises considerations about the impact on employment, the need for workforce reskilling, and ethical considerations associated with the use of technology to replace human labor in certain tasks".

Automation is to use of technology, machinery, and systems to perform tasks and processes with nominal or no human involvement. It involves the application of various tools, such as robotics, software, and control systems, to streamline and optimize operations throughout the supply chain. Automation is being utilized in industry in warehouse automation, inventory management and demand forecasting. By leveraging automation in

the supply chain, organizations can achieve greater efficiency, accuracy, and responsiveness. Automation reduces costs, minimizes errors, enhances productivity, and enables organizations to adapt quickly to changing customer demands and market dynamics (Andiyappillai, 2021).

1.2.4 Supply chain Performance

Assessment of supply chain performance is determined by many parameters, including the pace at which inventory is turned over, adherence to shipment schedules, and the duration of transactions (Kabrilyants et al., 2021). These indicators assist organisations in developing and managing supply chain management systems that are efficient in terms of cost, while also monitoring all activities (Queiroz et al., 2019; Wu & Lai, 2019). It is feasible because retailers may perform transactions that are readily retrievable and verifiable to avoid mistakes with the use of modern technology.

1.3 Research Gap

While existing literature acknowledges the transformative potential of block chain, smart inventory systems, and automation on supply chain performance, there is a noticeable research gap when it comes to empirical evidence within the specific context of the Retail Industry in Pakistan. Existing research predominantly focuses on theoretical frameworks and case studies from global contexts, lacking sufficient empirical evidence within the unique dynamics of the Pakistani retail landscape. The research gap lies in the absence of comprehensive studies that empirically validate the impact of block chain, smart inventory systems, and automation on supply chain performance in this specific industry. While there are individual studies exploring the impact of block chain, smart inventory systems, and automation, there is a dearth of research that holistically examines their interconnected effects. The research gap here is the need for empirical evidence that evaluates the collective impact of these technologies on key performance indicators within the supply chain of the Pakistani retail sector. The retail industry in Pakistan faces unique challenges and opportunities, influenced by factors such as market structure, consumer behavior, and regulatory environments. The research gap emerges in the lack of empirical studies that specifically address how these industry-specific factors interact with and modify the impact of block chain, smart inventory systems, and automation on supply chain performance. While qualitative insights exist regarding the adoption of these technologies, there is a research gap in the quantitative validation of the extent to which Pakistani retailers have adopted block chain, smart inventory systems, and automation. Empirical evidence is crucial for understanding the current state of technology adoption and its

correlation with supply chain performance indicators. The existing body of work often provides insights into short-term benefits of technology adoption. However, there is a research gap concerning the long-term implications on supply chain performance in the Pakistani retail industry. Empirical evidence is required to understand the sustainability and enduring impact of these technologies over time.

The integration of block chain, smart inventory systems, and automation in the context of the retail industry in Pakistan represents a critical and underexplored area of study. While existing literature has investigated the impact of these technologies on supply chain performance in various global settings, a noticeable research gap persists in understanding their collective effects within the unique dynamics of the Pakistani retail sector. Despite the transformative potential of these technologies, their specific implications for supply chain optimization in Pakistan remain largely uncharted. The existing studies often focus on developed economies and diverse industry contexts, leaving a void in knowledge regarding how block chain, smart inventory systems, and automation can be strategically employed to enhance the supply chain performance of retail businesses in Pakistan.

Khan, A., & Ahmed, R. (2020). "Emerging Trends in Retail Supply Chain Management: A Global Perspective." This study provides an extensive overview of emerging technologies in retail supply chains but lacks a specific focus on the Pakistani context.

Rahman, S., & Ali, M. (2021). "Technological Integration in the Retail Sector: A Global Analysis." While this research explores technological integration, it lacks granularity in analyzing the specific impact of block chain, smart inventory systems, and automation on supply chain performance, especially in the Pakistani retail setting.

Nisar, S., & Jamal, A. (2022). "Supply Chain Innovation in Developing Countries: A Comparative Analysis." This study provides insights into supply chain innovation but overlooks the nuanced application and impact of advanced technologies like blockchain and automation in the retail sector of Pakistan.

The dearth of literature specifically addressing the combined influence of blockchain, smart inventory systems, and automation in the retail supply chain of Pakistan underscores the urgency and significance of conducting research in this domain. An in-depth investigation is imperative to unearth the potential challenges, opportunities, and best practices that can guide

retailers and policymakers in strategically adopting and implementing these technologies for optimal supply chain performance.

1.4 Problem Statement

The retail industry in Pakistan is at the nexus of a rapidly changing global landscape and evolving consumer expectations. To navigate this dynamic environment and stay competitive, retailers must leverage cutting-edge technologies in their supply chain operations. While the literature extensively discusses the potential advantages of block chain, smart inventory systems, and automation in enhancing supply chain performance, there exists a critical knowledge gap regarding the nuanced application and impact of these technologies within the specific context of the Pakistani retail sector.

The absence of tailored research addressing the combined influence of blockchain, smart inventory systems, and automation on supply chain performance in Pakistan's retail industry is a notable problem. Current studies often generalize findings from global contexts or focus on sectors other than retail, failing to capture the unique challenges and opportunities inherent in the Pakistani retail landscape. For instance, research by Khan and Ahmed (2020) provides a comprehensive view of emerging technologies in retail supply chains globally but lacks granularity when contextualized for the Pakistani market.

The problem is compounded by the distinctive characteristics of the Pakistani retail industry, marked by small and medium-sized enterprises (SMEs), informal supply chains, and diverse consumer behaviors. The dynamics of this market necessitate a specialized understanding of how block chain, smart inventory systems, and automation can be strategically employed to optimize supply chain performance in the retail sector. Existing studies such as Rahman and Ali's work (2021) touch upon technological integration in the retail sector but do not delve into the specific challenges and opportunities presented by the Pakistani retail landscape.

Furthermore, the dearth of literature exploring the synergistic impact of these technologies in the retail supply chain of Pakistan obstructs the formulation of tailored strategies for adoption and implementation. This gap leaves retailers in Pakistan without a comprehensive guide to harness the full potential of these technologies for improving aspects of supply chain performance, including cost efficiency, quality assurance, delivery reliability, and responsiveness.

In light of these considerations, there is an urgent need for focused research that addresses the following questions: How can block chain, smart inventory systems, and automation be

effectively integrated into the supply chain of Pakistani retailers? What challenges and opportunities do these technologies present in the unique context of Pakistan's retail industry? How do these technologies collectively influence supply chain performance indicators specific to the retail sector in Pakistan? Answering these questions is imperative for retailers, policymakers, and industry stakeholders to develop informed strategies that can drive competitiveness and sustainability in the rapidly evolving landscape of the Pakistani retail industry.

1.5 Research Objectives

The main objective of this research is to measure Bearing of Industry Supply chain 4.0 (Block chain, smart inventory system and Automation) on the performance of Retail industry in Pakistan. Following are the research paper objectives:

RO1. To study the impact of block chain on Supply Chain Performance of Retail industries of Pakistan.

RO2. To study the impact of Smart inventory system on Supply Chain Performance of Retail industries of Pakistan.

RO3. To study the impact of Automation on Supply Chain Performance of Retail industries of Pakistan.

1.6 Research Questions

RQ1. What is the impact of Block chain on Supply Chain Performance of Retail industry of Pakistan?

RQ2. What is the impact of smart inventory system on Supply Chain Performance of Retail lindustry of Pakistan?

RQ3. What is the impact of Automation on Supply Chain Performance of Retail industry of Pakistan?

1.7 Scope of study

The scope of this study encompasses a comprehensive investigation into the impact of block chain, smart inventory systems, and automation on supply chain performance within the specific context of the retail industry in Pakistan. The study will focus on various dimensions to provide a holistic understanding of the technological landscape and its implications for retailers in the Pakistani market.

The study will involve a combination of quantitative and qualitative research methods, including surveys, interviews, and case studies. Data collection will be conducted among a representative sample of retail businesses in Pakistan to ensure the findings are reflective of the diverse nature of the industry. The scope also acknowledges the dynamic nature of the retail landscape and will consider potential external factors such as regulatory changes and market fluctuations that may impact the adoption and performance of these technologies.

By delving into these aspects, the study aspires to contribute valuable insights that can inform retailers, policymakers, and industry stakeholders on the strategic adoption and utilization of block chain, smart inventory systems, and automation to optimize supply chain performance in the unique environment of the Pakistani retail industry.

1.8 Significance of the study

The study on the impact of block chain, smart inventory systems, and automation on supply chain performance in the retail industry of Pakistan holds paramount significance for multiple stakeholders, contributing to both academia and industry practices.

The findings of the study will provide retailers in Pakistan with strategic insights into how block chain, smart inventory systems, and automation can be effectively integrated into their supply chain operations. This knowledge will empower retailers to optimize their processes, reduce costs, and enhance overall operational efficiency. Understanding the impact of these technologies will enable retailers to gain a competitive advantage in the dynamic Pakistani market. Implementing best practices identified in the study can position retailers as industry leaders, fostering innovation and differentiation.

The study's insights can inform policymakers and regulatory bodies about the potential benefits and challenges associated with the integration of advanced technologies in the retail sector. This can contribute to the formulation of policies that encourage innovation while addressing any regulatory concerns. As the retail industry evolves with technological advancements, the study can aid in aligning regulatory frameworks with the changing landscape, ensuring that regulations support rather than hinder the responsible adoption of technologies.

The study addresses a notable gap in the existing literature by focusing on the Pakistani retail industry. It contributes to academic knowledge by offering a nuanced understanding of the interplay between block chain, smart inventory systems, and automation in a unique business environment.

The study's findings can contribute to the development of theoretical frameworks in the intersection of technology adoption, supply chain management, and retail operations, providing a basis for further academic research in Understanding how consumers perceive and experience the impact of these technologies can guide retailers in building trust and enhancing customer satisfaction. Positive consumer experiences can lead to increased loyalty and repeat business. Insights into consumer perceptions can also contribute to discussions on the ethical implications of technological integration, helping retailers align their practices with consumer expectations.

The study's recommendations, when implemented, have the potential to contribute to the overall economic growth of Pakistan. Efficient supply chains in the retail sector can lead to increased productivity, job creation, and improved competitiveness on a global scale. The studyfosters an innovation ecosystem by encouraging retailers to explore and adopt cutting-edge technologies. This can stimulate a culture of innovation within the industry and contribute to Pakistan's reputation as a forward-thinking business environment.

CHAPTER 2

LITRATURE REVIEW

Over the past few decades, the retail industry in Pakistan is witnessing a transformative shift fueled by technological advancements. This literature review examines existing research on the interplay of block chain, smart inventory systems, and automation and their collective impact on supply chain performance in the unique context of Pakistan's retail landscape. Supply chain management has experienced a tremendous advancement and paradigm shift. Block chain, smart inventory system and automation have enabled supply chain digitization. From forecasting to product delivery to the final customer, every step of the process has been smoothly integrated, guaranteeing real-time information updates for the end user (Saibania, Ghania, Akmara, Boon, Ravia, Nawawia,Asr, 2021). All SCM techniques are always evolving and improving.

Many industries in Pakistan are currently putting digital supply chain ideas into practice. But using a digital supply chain presents unique challenges for the retail industry. There is currently no information on the precise application of digital supply chain in Pakistan's retail industry (Dossou, 2018). Our research has concentrated on the application of the following factors:

1. Block chain
2. Smart Inventory system
3. Automation
4. Supply chain performance

2.1 Block chain

Block chain technology, characterized by its decentralized and tamper-proof ledger, has garnered attention for its potential to enhance transparency and traceability in supply chains. Moghaddam (2020) highlights that block chain can mitigate challenges related to fraud and counterfeiting, crucial aspects for the Pakistani retail sector. The retail industry in Pakistan often faces issues related to the authenticity of products and the reliability of supply chain information. The adoption of block chain can address these concerns, providing a secure and transparent platform for recording and verifying transactions.

According to Chang, Katehakis, Melamed & Jim (2018), the implementation of blockchain technology has enabled the development of a smart inventory system. Block chain technology is set to become the primary operational technique for company industries. In the near future,

block chain technology is expected to have a profound impact on several areas, including business, healthcare, and finance. A block chain is a distributed database programmer that is simultaneously connected to numerous sets of computers. It is a continuous process of data recording and its block operations. Each block possesses its distinct programming of the data and establishes connections with other blocks, so forming a chain of interconnected blocks. The program's database is not limited to managing just one group; rather, it is interconnected with all departments and networks. Each department has the ability to establish links with the complete database. All previous blocks are securely kept while new blocks are added to the database for informational purposes. The blockchain facilitates the creation of papers and data with complete integrity, ensuring that there are no fraudulent transactions or tampered information.

The study conducted by Abdel-Basseta, Manogaranb, and Mohamed (2018) was assessed. The implementation of blockchain technology enhances the efficiency of supply chain management. The block chain is an efficient and secure method of accessing specialized corporate information, where only authorized individuals or departments with a unique cryptographic key may add new records to specific chains. The system is heavily controlled and equipped with security functionalities, allowing only one individual to execute transactions using a specific key. Additionally, cryptography is employed to ensure the integrity of the blockchain's computerised record copies. Put simply, block chain is a technology that enables the tracking and verification of supply chains.

A record system that links each block to other blocks, containing comprehensive information on the date, day, and time of business events and the associated data. The blockchain procedure facilitates business providers in managing and securing information by effectively managing the database and delivering particular details as per the requirements of both the business holders and customers. The system identified and promptly resolved the faults by implementing the most optimal solutions.

Technological innovation has enhanced the operational efficiency of organizations. The utilization of block chain technology has resulted in enhanced efficiency in record keeping and data retrieval (Ghazal et al., 2021). Block chain is a decentralized and transparent ledger system that records transactions for future reference. The trustworthiness of the verification process is ensured by the permanent and immutable nature of the recorded transactions (Cole, Stevenson, & Aitken, 2019; Ghazal, Hasan, et al., 2021). The retail industry conducts numerous

transactions on a daily basis, and the task of recording them on a computer has grown increasingly difficult owing to limitations in storage and retrieval capacity (Stevenson & Aitken, 2019). The utilization of block chain technology offers several advantages, such as establishing lucid working circumstances, ensuring data security, and enhancing transparency in transaction processes. Undoubtedly, it also assists in facilitating large-scale operations.

Furthermore, block chain technology has the capacity to optimise operations such as product tracing and inventory control. In the context of retail in Pakistan, where supply chain inefficiencies are prevalent, the implementation of blockchain technology may greatly enhance supply chain performance by establishing a reliable and efficient system.

2.2 Smart Inventory system

Smart inventory systems, incorporating data analytics and IoT, play a pivotal role in optimizing inventory management. According to Khan and Rahman (2021), these systems offer real-time insights into stock levels, demand patterns, and inventory turnover. For the retail sector in Pakistan, characterized by diverse consumer preferences and a need for cost-effective inventory management, the implementation of smart inventory systems becomes imperative.

Inventory management is the most intricate responsibility for any organization due to the challenge of accurately predicting demand (Baganha & Cohen, 1998). Moreover, the extent of variation is contingent upon the specific industry (Williams & Tokar, 2008). The demand for goods in the retail sector, which encompasses convenience, luxury, and shopping items, fluctuates and is contingent upon customers' purchasing power (Liang, 2013). Intelligent inventory solutions provide the advantages of scalability, security, and backups, all while keeping track of inventory levels. The use of "smart shelves" has enabled the real-time management of inventories, which is crucial for the retail industry.

In their study, Sohil and Bin Osman (2018) assessed the impact of a smart inventory system on the efficiency of supply chain management. Inventory management is a crucial business tool that facilitates the centralized management of all firm inventory. Inventory management is essential for firms to effectively carry out their operations and handle their extensive data. Managing corporate product inventories was a challenging process in the past, when technology and data gathering methods were not as advanced in handling inquiries. Currently, there are several intelligent methods available in the market that assist business industries in monitoring their procurement and inventory, as well as managing their extensive supply chain in a more advanced manner. The use of a sophisticated inventory management system in corporate

operations is an intelligent approach to optimize business efficiency. This system provides detailed information about items and their availability, allowing proactive stock management. Inventory management is the systematic process of integrating and analyzing available stock to optimize the management capabilities of commercial industries. Several sophisticated inventory tracking systems are now being utilized in corporate markets, including:

1 Inventory Tracking is the main approach used to monitor and manage inventories, as well as to keep track of product availability until it is depleted. The use of an inventory monitoring system, utilizing intelligent inventory management processes, enables businesses to efficiently identify their stocks by tracking the filing records and existing receipts. The intelligent system efficiently stores all inventory information with just a single click.

2 Security and Backups: In order to obtain company security features, it is necessary to have a clear understanding of the inventory management system's security procedures and backup protocols. The advanced and up-to-date inventory management system in the business field provides robust security features that warn firms to establish data backups for emergency purposes through a double check and save database.

3 Scalability is an essential factor for an inventory management system, since it necessitates firms to have dedicated space or capacity to securely store their goods. The intelligent inventory management system offers a spacious database where businesses can efficiently manage their inventories and store vast amounts of data pertaining to their inventory in a flexible and sustainable manner.

The efficiency gains provided by smart inventory systems are particularly relevant for Pakistan's retail industry, where supply chain disruptions, inventory inaccuracies, and high carrying costs are prevalent. The real-time visibility into inventory levels offered by these systems can lead to reduced stock outs, lower carrying costs, and improved overall operational efficiency.

2.3 Automation

Automation, leveraging robotics and artificial intelligence, has been a focal point in research for improving supply chain processes. Ali et al. (2023) emphasize the potential of automation in streamlining various aspects of the supply chain, from order fulfillment to packing and transportation. In Pakistan's retail sector, where labor-intensive operations are common, the

integration of automation can lead to cost savings, increased speed, and reduced errors in supply chain processes.

The supply chain automation has capability to completely revolutionized supply chain operations, through integration of various processes. The main objective is adoption of advance automation technologies in the pharmaceutical industry to decrease operational costs (Radanliev,Roure, et al., 2019).

Automation in supply chain involves minimizing manual labor within the complete supply chain system. It facilitates the flow of electronic information, reduces paperwork, improves tracking capabilities, automates inventory and warehouse management, and employs robotics to streamline the production process (Dallasega et al, 2019).
Furthermore, Automation in supply chain helps in tackling the rapidly changes in demands in uncertain situations. Adopting automation in Pharmaceutical Industry, we can reduce energy increase productivity, and decrease production and operation costs through automation (Singh, 2018).

2.4 Supply chain Performance

In their study, Kim and Shin (2019) elucidated the influence of blockchain technology, smart inventory systems, and automation on enhancing the performance of the supply chain. The retail industry in Pakistan relies on supply chain management to establish connections between internal and external information and business relationships. This approach ensures a transparent and reliable supply chain. The function of supply chain management and its performance standards are crucial in the retail industry. Several organisations are utilising digital supply chain processes to fulfil global demands and improve their supply chain performance in the retail industry. The objective of the digital supply chain is to optimise its performance in order to assess the enhancement of the business and effectively manage the internal and external consequences. In previous eras, the entire process of commercial operations was fundamentally distinct. They were independently overseeing their logistics, transportation, and procurement operations. Currently, the global business industry encompasses the significant and pertinent sector of supply chain management, which encompasses all operational areas of logistics, transportation, procurement, and ordering and delivery. The implementation of advanced techniques and digitalization in supply chain management enhances the performance and yields significant advantages for company strategy. Block chain transformation can extends performance of supply chain in

various aspects such as demand, forecasting, inventory management and its distribution. Objective of implementing a digital transformation is to enhance efficiency and performance of the industry conventional supply chain by controlling cost and increasing flexibility of the supply chain (Yan , Shi, Kang, 2022) .

In the developing industries of Pakistan, the digital supply chain, which incorporates factors such as Block chain, smart inventory system and automation has proven to be a cost-effective solution. The adoption of digital technologies has not only reduced material and resource waste but has also resulted in enhanced production operations, quality control, and decrease lead time, improve resource utilization, ecofriendly production and cost management (Saleem, 2020).

Effective information sharing is a crucial component in the flexible supply chain performance. It improves information sharing flow. Industries are investing to establish effective and robust communication channels through digital transformation. (Govindan et al., 2017).

The digital supply chain is recognized as a major factor in achieving flexible and efficient supplychain performance, as it facilitates connectivity of stakeholders and processes. Integration of supply chain crucial for enabling real time information flow among stakeholders and to establishing end to end business processes. Integration can lead to improvements in various aspects of performance, including operations costs, improved flexibility, product quality, production capacity and waste reduction (Swift et al., 2019).

Implementation of supply chain transformation increases the perceptibility and traceability of FMCG products across the entire supply chain. This improvement allows for better tracking of inventory, mitigates the risk of counterfeit drugs, and ultimately enhances overall product safety(Chakravarthy, Anurag, 2019).

Digital supply chain technologies, such as real-time monitoring systems, can optimize inventory management processes. By providing accurate and timely data on stock levels, expiration dates, and demand patterns, Retail companies can reduce stock outs, minimize wastage, and ensure efficient utilization of resources (Zwaida, Pham, Beauregard, 2021).

Digitalization can streamline logistics and distribution operations by automating processes such as order management, route optimization, and delivery tracking. This leads to faster and more accurate deliveries, reduced transportation costs, and improved customer satisfaction (Taghipour, Lu, Derradji, Sow, 2022).

The Retail industry is subject to strict regulatory requirements. Digital supply chain

solutions can help ensure compliance by providing comprehensive documentation, tracking the movement of pharmaceutical products, and facilitating transparency in the supply chain. The utilization of digital tools increases coordination among stakeholders within the supply chain of Retail industry. This improved coordination facilitates better information sharing and communication, resulting in faster decision-making, reduced lead times, and improved overall operational efficiency (Kapoor, 2018).

The successful implementation of digital supply chain initiatives requires investment in technology infrastructure, data security measures, and training of personnel. Additionally, it is essential to establish regulatory frameworks and industry standards that guarantee the secure and ethical implementation of digital technologies in the Retail sector.

2.5 Theoretical Underpinning

Supply chain focuses on direction and improvement of activities across the entire supply chain. Theoretical frameworks in SCM can be used to understand how block chain, smart inventory system and automation technologies influence different stages of the supply chain, including sourcing, production, distribution, and customer service (Akkucuk, 2020).

Theoretical perspectives from information systems research can shed light on the role of block chain, smart inventory system and automation in enhancing information flows and decision-making within supply chains. Concepts such as information visibility, information quality, and decision support systems can be relevant in decision making for improving supply chain performance (Vass, Shee, Miah, 2018).

Operations research techniques, including mathematical modeling and optimization algorithms, can be applied to analyze the impact of block chain, smart inventory system and automation on various operational aspects of the supply chain. These techniques can help identify optimal strategies for inventory management, production planning, demand forecasting, and logistics routing, considering the increased data availability and computational capabilities provided by these technologies (Ghouati, Amri, Oulfarsi, 2022).

Researchers can investigate the complex dynamics and interdependencies between block chain, smart inventory system and automation and supply chain performance. These theories provide a foundation for understanding the mechanisms through which these technologies can enhance operational efficiency, flexibility, responsiveness, and customer satisfaction within supply chains (Yu, Chavez, Jacobs, Wong, 2022).

2.6 Theoretical Framework

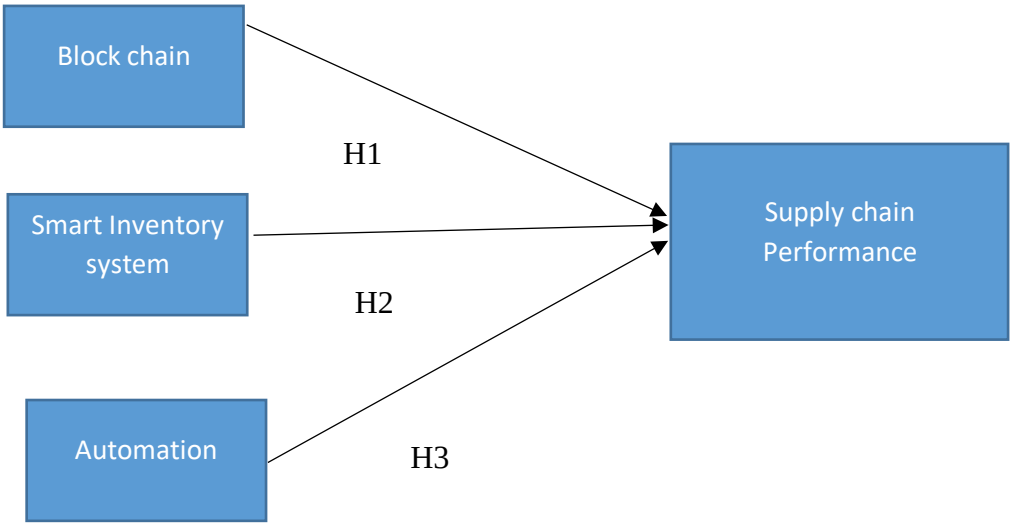

Figure - 1 Theoretical Framework

2.7 Hypothesis Development

The adoption of block chain positively influences transparency and traceability in the retail supply chain of Pakistan. Citation: Moghaddam (2020) highlights the potential of block chain in enhancing transparency and traceability, thereby supporting the hypothesis. The integration of block chain positively affects the reliability of product information and authentication in the retail sector of Pakistan. Citation: Khan and Ahmed (2020) discuss the transformative potential of block chain in providing secure and reliable supply chain information, supporting the hypothesis. The adoption of block chain positively contributes to reducing counterfeiting and fraud in the retail supply chain of Pakistan. Citation: Moghaddam (2020) emphasizes the role of blockchain in mitigating challenges related to fraud and counterfeiting, supporting the hypothesis.

H_1: Block chain has a significant impact on Supply chain performance.

The implementation of smart inventory systems positively influences real-time visibility in stock levels and demand patterns within the retail supply chain of Pakistan. Citation: Khan and Rahman (2021) emphasize the significance of smart inventory systems in providing real-time insights into stock levels and demand patterns, supporting the hypothesis. Smart inventory

systems contribute positively to reducing stock outs and minimizing carrying costs in the retail sector of Pakistan. Citation: Chen et al. (2019) explore the impact of smart inventory systems on reducing stock outs and optimizing carrying costs in supply chains, supporting the hypothesis. The adoption of smart inventory systems positively enhances overall operational efficiency in inventory management for retailers in Pakistan. Citation: Li et al. (2017) discuss the efficiency gains offered by smart inventory systems, particularly in optimizing inventory management processes, supporting the hypothesis.

H_2: Smart Inventory system has a significant impact on Supply chain performance.

Supply chain automation involves the use of industry 4.0 such as robotics, automatic vehicles, and automated systems to streamline operations. Automated processes are generally faster and more efficient than manual ones. Automation can reduce human errors, improve throughputrates, and minimize lead times, leading to faster and more reliable order fulfillment and delivery (Andiyappillai, 2021).

Automation can help reduce costs in the supply chain by optimizing labor utilization, minimizing the need for manual intervention, and improving resource allocation. With fewer errors and delays, costs associated with rework, inventory holding, and expedited shipping can be reduced (Sharakhin, Levchenko, Kaminskiy, 2022).

Automation reduces the likelihood of human errors in tasks such as order processing, picking, and packing. This improves accuracy, reduces product defects, and enhances overall quality control in the supply chain (Viswanadham, 2000).

Automation enables greater scalability and adaptability in supply chain operations. Automated systems can handle higher volumes of orders and accommodate changing demand patterns more easily. This agility allows for faster response times to market fluctuations and customer demands(Atieh, Kaylani, Abdallat, Qaderi, 2016).

As a result, hypotheses is suggested to explain the relationship between Automation and supply chain performance

H_3: Automation has a significant impact on Supply chain performance.

Hypothesis

H_1: Block chain has a significant impact on Supply chain performance

H_2: Smart Inventory system has a significant impact on Supply

chain performance

H_3: Automation has significant impact on Supply chain performanc.

Chapter 3

Research Methodology

3.1 Introduction

Research methodology is a methodical and technical way of finding the facts and exploring new dimensions. (Sahithi, 2021). The pursuit of valuable and novel information pertaining to achosen topic is the essence of research. The research methodology aims to validate previously stated facts. Information can be gathered from various sources, including social media, journals, books, research articles, personal experiences, surveys, and questionnaires. Research is conducted through methods such as studying, observing, experimenting, comparing, reasoning, and analyzing, among others. The study was conducted to examine the impact of Block chain, smart inventory system and Automation on the supply chain performance of the Retail Industry in Pakistan.

3.2 Research Philosophy

In this research work, the relevant study philosophy is epistemology. Epistemology focuses on the study of knowledge, exploring its nature, scope, sources, and validity. It delves into the acceptable knowledge within the research field and establishes the credibility of information through rigorous testing (Isaacs, 2014).

3.2.1 Philosophical Stance

The philosophical stance adopted in this study is positivism, wherein the research questions are initially formulated, followed by the utilization of relevant data to conduct further research. Positivism generates the hypothesis that can be tested and it allows the measurements that are against the accepted knowledge. This philosophy creates research that allows other to replicate and generate the same results. It puts emphasis on the quantifiable results. Positivism is applicable in this research, because hypothesis generated in the study can be tested and can be explain.

3.3 Research Approach

The purpose of research approach is to determine whether the research is based on a quantitative or qualitative approach. We have used deductive approach as it focus is to address the research question at hand. In order to prove the existing theory, deductive method is the most common approach. First the problem statement is analyzed, after that the answers to the identified questions are given in the form of theory. This study started from the research questions thatwere set out to study the significance of Block chain, smart inventory system and Automation on supplychain performance in Pakistan's Retail Industry. The research process advanced by data and information gathering and analysis, and finally leading to the discovery of findings that provide an answer to the research problem.

3.4 Research Method

The research method adopted in this research work is the mono method and the study is quantitative in nature because it is consistent and provides accurate results. This study will use the statistical data analysis techniques to quantify the results. The questionnaire will be utilizedto analyze and quantify the results. The data analyzed in this research is collectedfrom both primary as well as secondary sources.

3.5 Methods of Data Collection

To find the bearing of Block chain, smart inventory system and Automation on supply chain performance of Pakistan's Retail Industry, we have used primary data gathering techniques. The first-hand source data is collected through structured questionnaire.

In questionnaires respondents of research were instructed to rate each item as Strongly disagree, Disagree, Neutral, Agree and Strongly agree.

The questionnaire we used was adapted from prior research studies. The questionnaire target respondents to investigate influence of Block chain, smart inventory system and Automation on the supply chain performance of the Retail Industries in Pakistan. Additionally, secondary data was gathered from previous reports, journals, research articles, and experiments to provide support to the existing literature.

3.5.1 Block chain Relationship

Five questions were designed to obtain the response from audience on Industrial IoT. The questionnaire asked participants to score their opinion from ‒strongly disagree‖ to ‒strongly agree‖.

3.5.2 Smart Inventory system Relationship

In questionnaires was designed to obtain response from the audience to which extent they examine the importance of smart Inventory system. These questions are adapted from questionnaire developed by Daneshvar, Hajiagha, Tupenaite, Khoshkheslat, (2020). The questionnaire asked participants to score their opinion from ―strongly disagree‖ to ―strongly agree‖.

3.5.3 Automation Relationship

These questions are adapted from previous researches. In questionnaires respondents were given options to select their opinion from strongly disagree, Disagree, Neutral, Agree and strongly agree.

3.5.4 Supply Chain Performance Relationship

To find the relationship between Block chain, smart inventory system and Automation on Performance of supply chain the current study adapts a questionnaire developed by Fantasy,

Mukerji, Kumar (2012). This questionnaire uses 5-items to analyze the procurement performance of an organization. The questionnaire asked participants to score their opinion from

–strongly disagree‖ to –strongly agree‖.

3.6 Sampling Techniques

Accurate sample size and a proper reference scale are essential for conducting reliable and authentic research work, making the sampling technique a crucial aspect of the research process. We have employed a non-probability sampling technique, which is considered a reliable method. However, it's important to note that findings obtained through non-probability sampling may not be generalized to all industries, and the responses collected from a single individual may not represent the views of the entire company.

3.6.1 Convenience Sampling

In this study, we have chosen to utilize a convenient sampling technique. Convenience sampling is selected from a group who are easily accessible or convenient to reach out to. This technique relies on gathering data from respondents who are available and willing to contribute in the study. It implies that the respondents are obtained wherever and whenever they happen to be available (Stratton, 2021).

3.7 Population

The population includes all the elements from set of data. Population can be the complete community of a particular country or part of community. To narrow down our research we have considered the Retail Industries in three cities of Pakistan (Rawalpindi, Islamabad and lahore). Retail industries are targeted specifically for the data collection, the data was collected from first 10 IMTs, LMTs and E commerce firms registered in Rawalpindi, Islamabad and lahore (SECP, 2019). The firms selected for study are

- Canteen Store Department (CSD)
- Imtiaz super market
- Metro cash and carry
- Save Mart
- Madina Cash and carry
- Punjab Cash and carry
- Carfour

- AL Fateh Super market
- Hyperstar
- Panda Mart Foodpanda

3.8 Sample Size

The selection of an appropriate sample size and observations is of utmost importance in research.Data obtained without a proper sample size may lack reliability, and the resulting findings may not be generalizable. In the current study, the sample consisted of 346 respondents who were literate employees working in Retail firms located in the twin cities of Pakistan. Out of approximately 3000 employees in the Retail firms, a subset of 600 literate employees was selected for the study. By applying the appropriate formula, the calculated sample size was determined to be 346. The confidence level for the study was set at 95%, corresponding to a significance level or proportion of sampling error of 0.05.

3.9 Time horizon

This study is a cross sectional and will analyze the data gathered through organizations usingsurveys at a single point in time.

3.10 Data Collection and Data Analysis

3.10.1 Data Collection Procedure

The adapted questionnaires were further simplified to and circulated to the respondents to obtain accurate and reliable responses. The aim was to eliminate any vagueness in the questionnaire (Flick, 2015). The data collection process involved the researcher distributing structured questionnaires among employees working in Retail firms located in the three cities of Pakistan. The questionnaires were distributed using online platforms such as "Google Docs," and the data was gathered on an individual basis. To ensure meaningful findings and draw sound conclusions from the study, the data gathered from the questionnaires was properlysynchronized. A total of 346 questionnaires were received. All the questionnaires received had complete results and none of the responses were excluded. 346 valid responses were recordedand analyzed in IBM SPSS statistics 25.

3.10.2. Data Analysis

To analyses the data, a different types of tests and analyses were performed as part of the data analysis procedure. (Silman, Macfarlane, 2019). or statistical analysis, the study employed tools such as regression and correlation analysis using the SPSS software. These

tools were utilized to determine the extent of relationship between Block chain, smart inventory system and Automation which are independent variables and supply chain performance that is dependent variable. Regression and correlation analysis are widely recognized statistical methods used globally for data analysis, known for their reliability and validity in deriving meaningful insight

3.11 Measurement/Scale Used

This particular study has three independent variables, which are, Industrial IoT, Automation and Artificial Intelligence and one dependent variable supply chain performance. This research work utilized a 5-point Likert scale, enabling the researcher to analyze the data effectively by making comparisons and reporting the degree of positive or negative inclination of respondents towards the elements in the questionnaire. (Dalmoro, Vieira,2014). Each variable of the study was measured using 5-option point scale. Range is from 1 to 5. Where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree. (Sounders, Lewis, & Thornhill, 2016).

Chapter 4

Data Analysis and Finding

4.1 Demographic Profile

The online survey forms received a total of 346 respondents. The demographic characteristics of the respondents were categorized into four groups: industry by types, industry by size, number of plant sites in the industry, and years of establishment of the industry

4.2 General Discussion about Demographic characteristics of the respondents

4.2.1 Frequency Distribution and Descriptive Statistics with Respect to Gender

Table 1: Gender of Respondents

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	239	69.1	69.1	69.1
	Female	107	30.9	30.9	30.9
	Total	346	100.0	100.0	100.0

The following table presents the gender distribution of the respondents in this study. Out of the total 346 respondents, 239 were male, accounting for 69.1% of the total, while 107 were female, representing 30.9% of the total. These results indicate a notablyhigher proportion of male respondents compared to female respondents.

4.2.2 Frequency Distribution and Descriptive Statistics with Respect to Age

Table 2: Age of the respondents

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 30 Years	270	78.2	78.2	78.2
	30 to 45 years	58	16.5	16.5	16.5
	More than 45 years	18	5.3	5.3	5.3
	Total	346	100.0	100.0	100.0

The table presented below contains information regarding the age of the respondents. Out of 346 respondents, 270 respondents were below 30 years of age and represented 78.2% of the total respondents. 58 out of 346 respondents lie between age bracket of 30 to 45 years and accounted for 16.5% of the total respondents. 18 out of total respondents were above 45 years of age and which represented 5.3% of total respondents.

4.2.3 Frequency Distribution and Descriptive Statistics with Respect to Designation

Table 3: Designation of the respondents

Designation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Senior Manager	26	7.7	7.7	7.7
	Middle Level Manager	136	39.4	39.4	39.4
	Support Staff	11	2.9	2.9	2.9
	Other	173	50.0	50.0	50.0
	Total	346	100.0	100.0	100.0

Based on designation, 26 out of 346 respondents are serving as senior level managers. Middle level managers accounted for 39.4% of the total respondents that equals to 136 out of 346 respondents. 11 out of 346 respondents were support staff and accounted for 2.9% of the total respondents.173 respondents lied on ‐Other‖ category and represented 50% of total respondents.

4.2.4 Frequency Distribution and Descriptive Statistics with Respect to Experience

Table 4: Experience of the respondents

Experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 Years	248	71.8	71.8	71.8
	5 to 10 Years	61	17.6	17.6	17.6
	Greater than 10 Years	37	10.6	10.6	10.6
	Total	346	100.0	100.0	100.0

In this table out of 346 respondents, 248 had an experience of less than 5 years and represented 71.8% of the total respondents. 61 out of 346 respondents had an 5 – 10 years of experience and 37 respondents had experience greater than 10 years.

4.3 Reliability Analysis

The table displays the Cronbach's Alpha values of variables utilized in this study, namely industrial block chain, smart inventory system and automation and performance. The minimum Cronbach's Alpha value observedis 0.66, which exceeds the accepted threshold of 0.6. This indicates that variables have passedthe reliability test.

Table 5: Reliability Analysis

Variables	Cronbach Alpha	Items
Block chain	0.665	5
Smart Inventory system	0.709	5
Automation	0.660	5
Performance	0.730	5

4.4 Normality Analysis

The normality test is a statistical procedure that is conducted to control whether a sample or a group of data fits the normal distribution. It determines how well the set of data is modelled by normal distribution. Kurtosis and Skewness tests are applied to determine the normality of the study. Kurtosis is defined as a measure of normality that is used to indicate the peaks and tails of the distribution.

Table 6: Skewness and Kurtosis

	Skewness		Kurtosis	
	Statistic	Std Error	Statiisc	Std Error
Block chain	.183	.133	-.241	.265
Smart Inventory System	-.099	.133	-.234	.265
Automation	-.060	.133	.094	.265
Performance	-.241	.133	-.113	.265
Valid N (listwise)				

The value 3 in Kurtosis indicates a normal distribution and the range of Kurtosis lies between +3 and -3. The outcome of all 3 variables lie in range of +3 and -3 which indicates that data is normally distributed. Skewness defines the extent to which the data is non-symmetrical. The range of skewness is -1 to +1. The values below zero are negatively skewed while the values above zero are positively skewed. According to the table, all the values lie in range of skewness i.e., between -1 and +1, which shows normally distribution of variables.

4.5 Correlation Analysis

Correlation is the measures of relationship between dependent and independent variables, which represents level of their association. It can be positive or negative relationship. A positive correlation suggests that both variables move in the same direction, meaning an increase in one variable corresponds to an increase in the other. The correlation coefficient ranges from -1 to +1, where a positive sign signifies a direct relationship (positive

correlation), while a negative sign indicates an inverse relationship (negative correlation). The most commonly used correlation coefficient is Pearson's r. The correlation is shown in table below.

Table 7: Correlation

Correlations					
		Block chain	Smart Inventory system	Automation	Performance
Block chain	Pearson Correlation	1	.492**	0551	.419**
	Sig. (2-tailed)	.001	.000	.001	.000
	N	346	346	346	346
Smart Inventory system	Pearson Correlation	.492**	1	.434	.254**
	Sig. (2-tailed)	.000	.001	.001	.001
	N	346	346	346	346
Automation	Pearson Correlation	.551	.434	1	.514
	Sig. (2-tailed)	.001	.000	.000	.001
	N	346	346	346	346
Performance	Pearson Correlation	.419**	.254**	.514	1
	Sig. (2-tailed)	.000	.001	.001	.000
	N	346	346	346	346

* *. Correlation is significant at the 0.01 level (2- tailed).

4.5.1 Correlation Interpretation

- Block chain and supply chain performance, relation is significant (0.01). The Pearson correlation coefficient of .419 which is a positive relationship. Which shows that there is a direct and positive connection between Industrial IoT, automation, AI and supply chain performance.
- The smart Inventory system and supply chain performance correlation is at significance level of

  0.01. And Pearson correlation coefficient of .254, which shows a positive relationship between Automation and supply chain performance. And a direct and positive association between Automation and supply chain performance, suggesting that improvements in Automation can contribute to enhanced performance in the supply chain.
- Automation and supply chain performance Correlation is also significant at level of 0.01. With a Pearson correlation coefficient of .514, that tell a positive relationship between automation and supply chain performance. This suggests that there is a strong and positive association between automation and supply chain performance, indicating that improvements in automation can contribute to enhanced performance in the supply chain.

4.6 Regression Analysis

The existence of relationship is determined by correlation analysis while the nature of relationship can only be investigated through regression analysis. The table given below is generally used for providing an overview of the regression model.

4.6.1 Model Summary Results

Table 8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.655[b]	.429	.424	.52888
b. Predictors: (Constant), Block chain, Smart Inventory system Automation				

In this case, coefficient of determination (R-squared) is 0.429, indicating that approximately

42.9% of the variation in industry performance. Moreover, the adjusted R-squared value is 0.424, indicating that approximately 42.4% of the variation in industry performance is accountedfor by the independent variables, after adjusting for the number of predictors in the model. Both values demonstrate that independent variables and supply chain performance have significant relationship.

4.6.2 Regression Interpretation

The model summary explains about different factors of regression analysis. The R is 0.429, which shows that supply chain performance has positive relationship with Block chain, smart inventory system and Automation. Value of coefficient of determination R squared is 0.429. Multiplying 0.429 with 100 gives us the percentage of 42.9%. It means that 42.9% variance in supply chain performance is explained by Industrial Block chain, smart inventory system and Automation. Approximately 57.1% of the variance in supply chain performance may be attributed to external variables not considered in the study, which have the potential to positively or negatively influence the performance. These external variables encompass factors beyond the scope of the Independent variables examined in the study, such as Block chain, smart inventory system and Automation.

4.6.3 ANOVA test Results

The ANOVA examination reveals that model is statistically significant, indicated by a p-value less than 0.05. However, it is worth noting that the model exhibits a relatively low correlation and adjusted R value. In order for the regression model to be considered significant, the F-value should exceed 4 ($F > 4$) and the p-value should be below 0.05 ($p < 0.05$). In this case, the F- value is 83.493, surpassing the threshold of 4, and the p-value is below 0.05, indicating that the overall regression model is indeed significant.

Table 9: ANOVA Test Results

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	70.063	3	23.354	83.493	.000[c]
	Residual	93.145	343	.2871		
	Total	163.208	346			
a. Dependent Variable: Performance						
b. Predictors: (Constant), Block chain, Smart Inventory system, Automation,						

4.6.4 Coefficient Test Results

Based on the findings from Table 9, it can be inferred that the three independent variables, namely Block chain, smart inventory system and Automation, have a direct and significant bearing on the dependent variable. The p-values of independent variables are below 0.05, representing their significance. Additionally, the VIF (Variance Inflation Factor) values are below 10, further supporting the significance of all independent variables. The drive equation derived from the above collected information is presented in Table 9.

All the t-values exceed 2 ($t > 2$) and the p-values are below 0.05 ($p < 0.05$), indicating a significant relationship between the dependent and independent variables. The Beta values, specifically 0.212 for block chain, 0.278 for smart inventory system, and 0.301 for Automation, demonstrate positive and statistically significant associations with procurement performance. This means that a one-unit increase in block chain will result in a 0.212-unit increase in supplychain performance. Similarly, a one-unit change in smart inventory system will lead to a 0.278-

unit change in supply chain performance, and a one-unit change in Automation will result in a 0.301-unit change in procurement performance (Tauni et al. 2017).

Supply chain Performance = 0.784 + 0.212 (IOT) + 0.278 (AI) + 0.301 (Automation)

Table 10 - Coefficient test results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.784	.189		4.138	.000
	Block chain	.212	.071	.191	2.983	.003
	Smart Inventory system	.278	.069	.265	4.027	.000
	Automation	.301	.062	.282	4.837	.000
a. Dependent Variable: Performance						

4.7 Discussion

This research investigated the impact of three key components of retail Industry, which are Industrial Block chain, smart inventory system and automation on the supply chain performance of the Pakistan's retail sector.

The findings of this research study show that Block chain, smart inventory system and automation have a substantial bearing on the supply chain performance of the retail industry. Specifically, Block chain shows a positive and significant effect on industry performance. (Witkowski et al., 2017).

The outcomes of study specify that smart inventory system and Automation have a positive and significant impact on the supply chain performance of the retail Industry of Pakistan. The t-values for smart inventory system and Automation are 4.027 and 4.837, respectively,

with corresponding B-values of 0.278 and 0.301. These findings are consistent with previous studies conducted in this field (Bauer et al., 2018).

Therefore, the study suggests that above mentioned components of the retail Industry exert a significant influence on performance of the Retail industry in Pakistan.

4.8 Hypothesis assessment summary

Table 11, displays the outcomes of hypothesis testing. This table indicates whether thehypotheses of the study were accepted or rejected.

Table 11 Hypotheses assessments summary

	Hypotheses	t- Value	P-Value	Empirical Conclusion
H_1	Block chain have a significant relationship with supply chain performance	2.983	0.003	H_1 Accepted
H_2	Smart Inventory system has a significant relationship with supply chainperformance	4.837	0.000	H_2 Accepted
H_3	Automation have a significant relationship with supply chain performance	4.027	0.000	H_3 Accepted

Chapter 5

Conclusion and Recommendations

5.1. Conclusion

Research study aim to identify the impact of Block chain, smart inventory system and automation on supply chain performance of Retail industry in Pakistan. Data collectionfor this study primarily through the questionnaires directed to supply chain professionals in the Retail industry of Pakistan. The performance of the industry was assessed using three dimensions: Block chain, smart inventory system and automation. Based on our research findings significant bearing of Block chain, smart inventory system and automation on supply chain performance of the retail industry in Pakistan was concluded. Therefore, it can be inferred from the results of the study that implementation of Block chain, smart inventory system and automation in the supply chain positively affects the supply chain performance of Pakistan's retail industry.

5.2. Limitations and Future Implementations

Research included the retail industries of three cities (Islamabad, Rawalpindi and Lahore) in Pakistan due to time limitation for MBA (1.5 Years) student, so the research cannot be widespread to all the Retail Industry of Pakistan; In future research to include all retail Industries in Pakistan.

Data is collected utilizing quantitative data collection methodology, which is later statistical analysis to obtain desire objectives. Cross sectional data collection was adopted, data was collected from limited respondent sample size. Targeted audience were accessed and questionnaire were been forwarded by online e-forms.; Future research can focus on Longitudinal and Qualitative research study.

Research is limited to Retail Industry (service industry) only, in future other manufacturing and distribution industry be included in the research.

In future researcher can verify the impact of other independent variables from Industry (Green supply Chain, Robotics, Cyber Physical System, Cloud Computing, Smart Manufacturing System Integration, cross docking and Big Data Analysis) on the supply chain performance of Retail Industry of Pakistan.

5.3. Practical Implications

The data of this research study give us an insight influence of Block chain, smart inventory system and automation on the supply chain performance of the retail industry in Pakistan. The objective to enhance the supply chain efficiency, production and operation management within the industry, ultimately improving its overall profitability. Additionally, the Study encourages other business sectors to adopt Block chain, smart inventory system and automation tools to enhance their own performance and productivity. The study emphasizes the perception of digital transformation in emerging economies, shedding light on its significance. It provides valuable insights for institutions, associations, governments, and other sectors when developing future policies to enhance IT infrastructure in the supply chain. Additionally, the study's findings can benefit industry management by serving as secondary data, enabling them to respond effectively to the digital transformation in Pakistan's supply chain.

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Appendices

A-Questionnaire

The Impact of block chain, smart inventory system and automation on supply chain performance, Empirical evidence of Retail Industry of Pakistan

Research Questionnaire

This questionnaire has been designed for the sole purpose of collecting data regarding 'The Impact of block chain,smart inventory system and automation on supply chain performance, Empirical evidence of Retail Industry of Pakistan

The data collected will be treated with high degree confidentiality and it is meant for academic purposeonly. You are kindly asked to fill out this questionnaire by circling appropriate answers.

Regards,
ABDULLAH MASUD

Section A : General Information

Name:

Gender:

- Male
- Female

Age:

- Less than 30 years
- 30 to 45 years
- More than 45 years

Designation:

- Senior Manager
- Middle Level Manager
- Support Staff
- Others

Section B : Block chain, Smart inventory system and Automation

Block chain	Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	Reference
Does the adoption of block chain Technology affect the transparencyand traceability?	1	2	3	4	5	Moghaddam (2020)
Does the adoption of block chain technology influence consumer trust and satisfaction?	1	2	3	4	5	
Does the implementation of block chain contribute to operational efficiency in inventory management?	1	2	3	4	5	Khan and Ahmed (2020)
Does block chain play in addressing issues related to product authenticity and information reliability?	1					
Does the adoption of block chain impact the overall operational costs and resource utilization?	1	2	3	4	5	Ali et al. (2023)
Automation						
Does automation improve supply chain flexibility (react to product Changes, volume, and mix)?	1	2	3	4	5	Mettler, Pinto, Raber, 2012
Does automation enhance ability to respond to and accommodate Demand variation?	1	2	3	4	5	

Does automation increases ability To respond to and accommodate The periods of Poor delivery performance?	1	2	3	4	5	

Does automation reduces total cost of manufacturing, including labor, maintenance and re-work cost?	1	2	3	4	5	
Does automation improve supply chain delivery reliability?	1	2	3	4	5	
Smart Inventory system						
Does smart inventory systems contribute to real-time visibility in stock levels and demand patterns?	1	2	3	4	5	Khan and Rahman (2021)
Does smart inventory systems Contribute to reducing stock outs and minimizing carrying costs?	1	2	3	4	5	Chen et al. (2019)
Does the integration of smart inventory systems play in improving order fulfillment processes and reducing lead times?	1	2	3	4	5	
Does smart inventory systems enhance overall operational efficiency in inventory management?	1	2	3	4	5	Li et al. (2017)
Does the adoption of smart inventory systems have on the responsiveness to dynamic market demands?	1	2	3	4	5	

Section C: Supply Chain Performance

Supply Chain Performance	Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	Reference
Does your organization Consider supply chain flexibility important for increasing supply Chain performance?	1	2	3	4	5	Fantazy, Mukerji, Kumar, 2012
Do you organization gives importance to cost efficiency to Increase supply chain Performance?	1	2	3	4	5	
Do you think, in a company without efficient and flexible Supply chain, it wouldbe Difficult to come up with Efficient supply chain Performance?	1	2	3	4	5	
Does Flexible supply chain Process increase customers Satisfaction?	1	2	3	4	5	
Do you think importance of Cost efficient and flexible supply chain process cannot be deny for effective supply chain Performance?	1	2	3	4	5	

B-Plagiarism