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# INFLUENCE OF CLOUD-BASED WAREHOUSE MANAGEMENT SYSTEMS IN OPTIMIZING BUYER–SUPPLIER RELATIONSHIPS: A SYSTEMATIC REVIEW

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### Abstract

**Purpose:** Industry 4.0 is viewed as an important tool for achieving competitive advantage. The purpose of the study was to establish the influence of cloud-based warehouse management systems in optimizing buyer-supplier relationships. **Methodology:** Kitchenham and Charter's guidelines on conducting a systematic review served as the direction for this study's review process. The study examined papers on cloud-based warehouse management systems that were posted on different sites, such as Google scholar, from 2019—2023.The study considered studies from different sectors in different countries. Inclusion and exclusion criterion was used to select the most relevant studies.24 studies were examined. **Findings:** The study concluded that cloud-based warehouse management systems have benefits and downside risks, as some business functions will have to change to adapt to smart warehousing. The adoption of Industry 4.0 technologies such as cloud-based WMSs enhances traceability and real-time sharing of information between buyers and suppliers. On another hand the study highlights barriers to adoption of cloud based-warehouse management systems such as security threats, insufficient technological infrastructure and government regulations. **Implications for theory and practice:** The study findings corroborate the Technology – Organization – Environment theory which posits that a technological infrastructure that is scalable may adjust to shifting requirements and business needs, guaranteeing that the system can manage rising data and traffic volumes. The study supports the claim by highlighting insufficient technological infrastructure as a barrier to adoption of cloud-based warehouse management systems. Industries such as small to medium enterprises shows a lower adoption rate of cloud –based warehouse management systems which are likely influenced by lack of technological infrastructure and financial constraints. This calls for partnerships and collaborations among government and stakeholders to promote adoption of these smart technologies. Consistent assessments and monitoring of cloud security protocols ensure ongoing compliance and reduce risks related to data handling and storage. Also there is need to use data analytics to demonstrate benefits of adopting cloud-based warehouse management systems and optimize solutions so as to encourage adoption of these smart technologies. **Originality and value**: Visibility and traceability has become important for supply chains that are increasingly operating in competitive markets. The current study has tried to answer questions on how cloud-based warehouse management systems impact buyer-supplier relationships and barriers to adoption of these industry 4.0 technologies. Several studies were carried out in developed countries with very little research conducted in developing nations. The research points out the need for increased government support, human capital and financial resources in developing countries to keep abreast of the latest trends. The research will also help to deepen the appreciation of industry 4.0 technologies in enhancing buyer supplier relationships. This study provides insights into barriers that are slowing the adoption rate.

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**Keywords:** Warehouse Management Systems, Buyer-Supplier Relationships, Cloud-Based Warehouse Management Systems, Industry 4.0.

## 1. INTRODUCTION

The scaling up of Industry 4.0 technologies over the past few decades has been unparalleled. However, there is still a lack of digitization and automation in most areas of the textile industry. Owing to fierce competition, supply chain managers are being pushed to concentrate more on procedures and opportunities in the management of the supply chain, which eventually results in the production of value for customers. Visibility has become important for manufacturing supply chains that are increasingly operating in competitive and volatile markets (Sodhi, 2019).

The effective management of inventory plays a crucial role in improving operational efficiency. Different types of warehouse management systems have been proposed, and most of these require different firm resources for successful deployment. As a result of the introduction of these Industry 4.0 technologies, there has been a shift in the manufacturing industry as well as a dramatic shift in how warehouse management operations are being conducted, moving them toward a higher level of traceability, responsiveness and visibility (Dhamija, 2020; Ali, 2020).

Even though cloud-based warehouse management systems provide businesses with vast advantages for improving operational efficiency, implementing these technologies requires many resources and has drawbacks such as security risks (Tadapaneni, 2020; Alouffi, 2021). There have been no studies on cloud-based warehouse management systems and how they affect buyer–supplier relationships in Zimbabwe’s textile industry. This study reviews earlier studies of cloud-based warehouse management systems and buyer–supplier relationships. This involved focusing on Industry 4.0 technologies such as the Internet of Things (IoT), cloud RFID and cloud architecture.

## 2. BACKGROUND OF THE STUDY

For many firms, cutting costs while manufacturing and delivering goods and services in an efficient manner is an essential objective. Positive results can emerge from implementing lean management practices. But the current global supply networks are not responsive enough to match lean strategies' short lead periods. This lack of reactivity makes it more difficult to apply lean principles to international supply chains. Consequently, companies could encounter difficulties realizing the complete advantages of lean management methodologies (GIANNAKIS, 2019).

The advancements in digital communication platforms and information technology in recent times have raised awareness of the potential advantages of applying these technologies to improve supply chain performance. It is becoming more and more clear that supply chain operations can be enhanced by the effective integration of these industry 4.0 technologies. The implementation of these technologies is thought to be a critical component in improving supply chain efficiency (Hsu et al, 2014).

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The effective management of inventory and warehouses plays a pivotal role in the supply chain. In past studies, different architectures of warehouse management systems (WMSs) and automation techniques have been proposed, and some lack successful deployment.

McCrea (2019) described a WMS as a “traffic cop” providing inventory visibility while gathering actionable data analytics for companies to utilize. Depending on the needs of the business, cloud service providers offer a variety of service models; nevertheless, the fundamental service models only offer three types of services: infrastructure, platform, and software services in a pay-as-you-go manner via the internet (Senyo, Addae, & Boateng, 2018; Abdulsalam, & Hedabou, 2021; Alam, 2020; Jamsa, 2022). Cloud-based WMS can integrate with ERP, CRM, and inventory management systems to offer a comprehensive view of warehouse operations and performance. Firms need to also consider factors such as scalability and compliance with industry regulations and standards before the adoption of cloud WMSs.

Industry 4.0 was first coined in 2011 in Germany as an initiative between the Federal Government, universities and companies to develop advanced production systems (Zimmerman, 2021). One of the broader technologies of smart warehousing is cloud warehouse management systems, which can be used to improve warehouse management and to address a number of issues faced in the manufacturing sector. Cloud WMS can improve inventory flow by increasing the traceability and visibility of products while shortening product delivery cycles (Yasaman et al., 2022; Dhamija, 2020; Ali, 2020; Patrucco et al., 2021).

Warehouse managers can coordinate the preparation and selection of a docking spot based on location and arrival time by interacting with the intelligent warehouse management system. RFID sensors will reveal delivery data simultaneously. This makes it possible for the system to effectively plan just-in-time and just-in-sequence delivery. To guarantee prompt and orderly delivery, the process of choosing and setting up docking slots can be expedited by enabling communication between transporters and the warehouse management system. (Mashayekhy, 2022).

Despite cloud-based warehousing solutions having a significant impact on many industries, several small- to medium-sized businesses still find it difficult to properly integrate these systems because of limited resources and therefore not realizing the full benefits. Cloud computing services can expose users to security concerns such as shared cloud computing services, internal and external threats, inadequate backups, phishing and social engineering (Thanasegaran, 2022; Alouffi, 2021; Sun, 2020; Vinoth, 2022).

The high lifetime costs of Industry 4.0 technologies frequently make organizations hesitant to adopt them. For those who have already put the technology into practice, there may be issues with system upkeep as well as financial and mistakes in the system. Inadequate maintenance can result in unreliable systems, which puts enterprises behind schedule in guaranteeing the effective operation of Industry 4.0 technology (Tikwayoet al,

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2023). The adoption of Industry 4.0 technologies necessitates effective collaboration and coordination among the different actors and stakeholders in the supply chain to optimize the value chain. This integration involves ensuring seamless communication and cooperation between all stages of the value chain to fully leverage the benefits of Industry 4.0 technologies (Barreto et al, 2017)

## 3. RESEARCH QUESTIONS

How does the use of cloud-based systems impact buyer–supplier relationships?

What are the barriers to implementing cloud-based warehouse management systems?

## 4. THEORETICAL FRAMEWORK

Many theories have been used to describe the adoption of Industry 4.0 technologies. This study focused on technology–organization–environment theory and diffusion of innovation theory.

### 4.1 Technology – Organization – Environment theory

The TOE framework was introduced by Tornatzky and Fleischer in 1990 to evaluate and analyze technological innovation and implementation in technological, organizational and environmental contexts (Kamruzzaman et al, 2019; Qu et al, 2014). Under each context, the theory went on to describe factors that affect each context. By examining these factors, firms can make informed decisions before adopting these Industry 4.0 technologies. As proven by other previous studies, such as that of Nguyen and Luu (2020), the TOE framework provides a strong theoretical foundation to explain the adoption of these technologies by firms. Kuan and Chau (2001) also documented the suitability of the framework in analyzing and predicting technological adaptation at the organizational level.

Government laws and industry pressure are two important environmental elements that influence an organization's decision to implement new technologies. The adoption of innovation is stimulated by competitive pressures. Government regulation can also influence innovation in a positive or negative way. The introduction of new regulations, such as the need for pollution control equipment for energy companies, makes the demand for innovation in such companies' mandatory. This finding unequivocally demonstrates how government regulation can either promote or inhibit innovation (Burger, 2023).

The organizational context represents the internal factors in an organization that influence innovation adoption and implementation. Organizational context refers to descriptive measures of the organization, such as scope, size, organization structure, financial support, managerial beliefs and top management support. Zaltman et al. (1973) reported that organic and decentralized organizational structures may be best suited to the adoption phase of the innovation process, whereas mechanical structures are best suited to the implementation phase of innovation owing to their formal reporting relationships

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and centralized decision making. Top management can help foster innovation by creating an environment that welcomes change and in support of innovations that further the firms' core business.

Technological support infrastructure, as another important factor of the TOE framework, plays a crucial role. It entails all the technologies that the firm is already using and those that are available on the market but not currently being used. Technologies that firms are currently using are important in the adoption process because they set some boundaries on the scope and pace of technological change that a firm can undertake (Baker, 2011). Three types of innovations exist outside the firm: those that create incremental, synthetic, or discontinuous changes (Baker, 2011).

Businesses need to carefully assess what kinds of organizational adjustments the adoption of new technologies will entail. A technological infrastructure that is scalable may adjust to shifting requirements and business needs, guaranteeing that the system can manage rising data and traffic volumes. Strong security measures will also be offered to guard sensitive data and stop online threats. Businesses can strengthen their competitive advantage by adopting and implementing technology with a solid technological foundation if they prioritize these elements.

### 4.2 Diffusion of innovation theory

Diffusion of innovations is a theory profound by Everett Rogers (2003) that seeks to explain how, why, and at what rate new ideas and technology spread. Diffusion occurs through a five–step decision-making process which involves awareness, interest, evaluation, trial, and adoption (Liu, 2019). The innovation decisions include optional innovation-decisions, collective innovation-decisions and authority innovation-decisions (GARCÍA-AVILÉS, 2020). Managers will have a greater effect on others attitude to accept innovation. These elements play a crucial role in determining the adoption and diffusion of an innovation this theory Rogers proposes that four main elements influence the spread of a new idea:

Innovation as one of the factors is defined by Jonsson (2015) as the utilization of new technology in an organization. The newness characteristic of an adoption is more related to the three steps (knowledge, persuasion, and decision) of the innovation-decision process. Uncertainty is an important obstacle to the adoption of innovations. Users are better able to weigh the risks and rewards of adopting an innovation when they are aware of its benefits and drawbacks. They can use this knowledge to make decisions that are in line with their values and aspirations (Sahin, 2006).

Communication channels are another important factor. According to Rogers (2003), communication is a process in which participants create and share information with one another in order to reach a mutual understanding. Diffusion is a specific kind of communication and includes these communication elements: an innovation, two individuals or other units of adoption, and a communication channel. (Sahin, 2006).

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Social system as another factor which plays a crucial role. According to the theory, user perceptions of the system and technological features have the biggest impact on whether or not innovation is adopted.. Discoveries spread over time through specific channels and inside a specific social structure (Espadanal et al, 2012). The speed at which an innovation is adopted in a society is also positively impacted by its compatibility. A more compatible innovation spreads more quickly than one that is incompatible with societal norms, individual conventions, or personal beliefs (Amini et al, 2015).

Managers can successfully execute innovative and creative changes by applying the theory. (Kaminski, 2011). Diffusion of innovation theory was used to identify the factors that promote cloud-based warehouse management system adoption and determine the process by which the concept is adopted (Mohammadi, (2018). Knowledge is what pushes people to accept change and provides them with comprehension of such changes. The theory provides insightful information about how human resources development initiatives for cloud-based warehouse management systems can be implemented successfully. These insights can be used by managers to increase the efficacy and efficiency of their personnel development and training programs.

## 5. METHODOLOGY

A systematic literature review is a way of synthesizing scientific evidence to answer a particular research question in a way that is transparent and reproducible while seeking to include all published evidence on the topic and appraise the quality of this evidence (Lamé, 2019). It also includes a search approach, stating inclusion and exclusion criteria and producing a qualitative appraisal of articles" (Jesson et al., 2011). When conducting a systematic review, Kazemi et al. (2019) highlighted the following actions:

### 5.1 Search strategy

Using electronic databases such as Google Scholar, Scopus and Web of Science, the researcher conducted a keyword search. The research question is divided into many terms to create a search string. Keywords such as "buyer–supplier relationship", "cloud-based warehouse management systems", and "Industry 4.0" were used to find the relevant information. This study examined papers that were published at different sites from 2019--2023.

### 5.2 Selection process

The selection process involves three stages. Correct results are not always returned in database searches; therefore, duplicate records and irrelevant articles were excluded using the inclusion and exclusion criteria. The inclusion criteria were as follows: (1) studies focused on how Industry 4.0 enhances buyer–supplier relationships, (2) studies published in English, and (3) studies focused on how cloud-based warehouse management systems improve organizational performance. Creating the review protocol, specifying the selection criteria, carrying out the review process, and reporting the results are the four stages that make up Kitchenham and Charters' (2007) guidelines.

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### Phase 1

After searching for articles in pertinent databases, 108 studies were found. The first inclusion criterion is used to take into account the five years of articles. Extra criteria were applied throughout the process. All the articles on the list had a word cloud in their title, in other words, buyer–supplier relationships, warehouse automation and Industry 4.0.

### Phase 2

More criteria are utilized in this stage to narrow down the articles. Duplicate files were removed, and irrelevant articles were excluded on the basis of their title. Review pieces, editorial prefaces and non-English articles were removed. Fewer papers were selected because of this.

### Phase 3

During this stage, every item that made the short list was thoroughly studied to look for solutions to the study question and goals. Twenty-four articles were included in the systematic review.

### 5.3 Data collection process

Data were extracted by two reviewers to eliminate bias.

### 5.4 Synthesis method

A richly detailed collective meaning of a few chosen studies was provided through the application of a narrative analysis approach. This featured a summary of the elements that businesses should take into account prior to implementing a cloud-based system and the ways in which using one affects interactions between buyers and suppliers. A meta-analysis was used to extract quantitative data. Patterns among the qualitative data were found, examined, and reported via thematic analysis. It aids in clarifying the more general trends of how cloud warehouse management systems optimize buyer–supplier interactions throughout a dataset. It highlights the relationships between several variables.

## 6. LITERATURE REVIEW

To concentrate on important factors that are defined by the study questions, a literature review was conducted. The barriers to cloud-based warehouse management system adoption and the effects of cloud-based system use on buyer-supplier relationships. The section commences with an overview of buyer–supplier relationships.

### 6.1 Overview of buyer–supplier relationships

Finding and developing the best suppliers helps increase a business's competitive advantage. The relationship that exists between suppliers and customers is essential for any firm that wants to be adaptable and change with time. If the ties between buyers and suppliers are constrained, it becomes difficult to achieve flexibility (Ampe-N'DA, 2020). The need for businesses to be efficient and competitive has pushed them to forge closer

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relationships with their suppliers in addition to learning that true competitive battles are fought along a chain of collaborating businesses (Abe et al,2021).

Recently, the importance of overseeing supply chain performance has increased in tandem with suppliers' contributions to the prosperity of enterprises. The relationship characteristics encompass transactional, collaborative, and strategic orientations in organizations, as outlined by Zimmerman (2021). The transactional orientation focuses on short-term exchanges and efficiency in business operations.

A collaborative orientation emphasizes teamwork and partnerships within and outside the organization. Strategic orientation involves long-term planning and decision-making to achieve organizational goals and competitive advantages**.** Strategic alliances aim to assist both buyers and suppliers, and they may have an impact on the characteristics of performance reviews (Jääskeläinen et al, 2021; Andiyappillai, 2020).

Effective governance mechanisms support interfirm relationships, which yield advantages such as relationship-specific investments, knowledge sharing, collaborative learning, complementary resources, unique goods and services, and lower transaction costs.

Buyer–supplier cooperation is strengthened by commitment and trust (Jääskeläinen et al, 2021; Mpinganjira, 2021). The supplier's compliance with contractual commitments is a critical component of the buyer-supplier relationship. Suppliers adhere to relationship-specific investment, service quality, and strategic relationship management to increase their credibility with buyers. (Rajagopal, 2009).

### 6.2 Relationship between cloud warehouse management systems and buyer–supplier relationships

The integration of cloud-based warehouse management systems has been found to positively impact the efficiency and coordination of buyer-supplier relationships within supply chains. Organizational resources become more agile and scalable as a result of the use of cloud warehousing systems, which enables businesses to adapt to changing market conditions (Golightly et al., 2022).

Industry 4.0, characterized by cloud computing, big data analytics, and the Internet of Things, enhances buyer–supplier relationships and supply chain management by interconnecting various companies, production sites, and operations (Tjahjono et al., 2017). These advanced technologies facilitate seamless communication and collaboration among different entities within the supply chain, leading to improved efficiency and productivity**.**

The widespread traceability and visibility of commodities enabled by technology, business partner connectivity, and smart warehousing contribute to increased resilience, flexibility, and agility in customer service. These advancements in technology and connectivity allow for improved tracking and monitoring of goods throughout the supply chain, leading to more efficient and responsive customer service (Mahmood, 2011; Schmidt et al, 2022).

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Cloud computing enhances communication in buyer–supplier partnerships by enabling the instant exchange of strategic and operational data related to production, finance, research and development, and competition.

This real-time sharing facilitates better collaboration and decision-making between partners. By leveraging cloud computing, organizations can streamline their processes and improve efficiency in managing buyer–supplier relationships. The ability to access and share data seamlessly allows for quicker responses to market changes and better alignment of goals between partners **(**Dweekat et al, 2017**;** Hirvi et al, 2021).

By harnessing cloud computing capabilities, organizations can streamline the processes of procurement, warehousing, and product handling (Dweekat et al, 2017). Data can be utilized to aid in the organization and coordination of real-time planning and processing through generation, analysis, and visualization. This approach allows for efficient decision-making and resource allocation by providing timely and relevant information (Kamruzzaman et al, 2019).

### 6.3 Barriers to adoption of cloud-based warehouse management systems

#### Regulatory barriers

Technological developments could give rise to significant public policy issues. Such as cyber security concerns. Stringent cyber security regulations can create an unfavorable environment for firms to adopt industry 4.0 technologies. They may also come with complex licensing procedures which will in turn slow down technological innovation. Limited government initiatives and incentives may discourage adoption. These initiatives might make the atmosphere more unfavorable for the use of cutting-edge technical solutions across a range of businesses. In addition, unclear or restrictive IP laws can limit technological innovation.

#### Technological barriers

End-to-end digital integration of all supply chain participants is necessary for Industry 4.0. Many small to medium enterprises s find the application of Industry 4.0 to be inconvenient because there are few established protocols and few resources available. Among the technological obstacles include insufficient technological infrastracture (Tabrizchi et al., 2020; Singhet al., 2019).

The costs involved with the lifetime of the systems tends to make organizations reluctant in implementing these Industry 4.0 technologies and with organizations that have already implemented the technology, they tend to fall behind on the maintenance of these systems due to costs and system inaccuracies, as no maintenance causes the systems to be unreliable.

Also, For technologies like as cloud RFID and AMRs to accomplish corporate goals, they must be connected to information technology networks. One problem is an inadequately integrated information technology network. This obstacle may make it more difficult to use these technologies effectively to accomplish organizational objectives. Thus, incorporating a helpful IT network is essential for an installation to be effective.

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The success of a company might be hampered by the failure to integrate these technologies with IT networks and reduce operational efficiency. Organizations must give top priority to integrating IT networks with cutting-edge technology in order to get past this obstacle (Tikwayo et al,2023). With the implementation of technology, there should be an integrated infrastructure for all functions and their processes.

The complex physical environment and layouts that were not intended for such installations prevent the implementation of new technology in warehouses. Determining the best course of action and financial feasibility for procuring Autonomous Mobile Robots (AMRs), designing their path, and overseeing their operations are difficult tasks.

Because of these challenges, implementing AMRs in warehouses is challenging because the current layouts were not designed with these technologies in mind. It is necessary to evaluate the operational, financial, and appropriateness elements of deploying AMRs.

**Economic**

Cloud warehouse management systems require significant investment, making it challenging for small to medium enterprisess in developing regions to adopt these high-end technologies because of their limited financial resources and lack of understanding (Chauhan et al 2021). Lack of skill hinders the use of technological systems is another factor. The personnel that use the systems need to have the skills associated with using the system so to ensure ease and user friendliness when using the systems.

The lack of skill can influence failure to adopt a system or benefit from its implementation. Similarly, the lack of sufficient resources resulting in inadequate maintenance has an impact on how reliable the technology is perceived by management as a source of information. Decision-makers may begin to question the technology's efficacy and accuracy in providing information as a result of this lack of support. Small and medium-sized businesses are having challenges integrating Industry 4.0 technology in sustainable industrial environments.

These companies are finding it challenging to incorporate cutting-edge technologies into their daily operations due to the evolving demands of their customers (Kumar et al, 2022). Their short term strategy also plays a significant role in hindering them to adopt these smart technologies.

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## 7. RESULTS

**Table 1: above shows the articles that were included in the study**

| Author | Title | Publication year | Region | Industry | Findings |
|---|---|---|---|---|---|
| Pathak | "Understanding the impact of digitization on buyer supplier relationship: A qualitative approach." | 2023 | India | Service sector | Subsequent research efforts ought to refine the findings by scrutinizing the buyer-supplier associations concerning supplier classification and by taking into account additional digital innovations like artificial intelligence and machine learning. |
| Zimmer man | "Exploring the influence of industry 4.0 technology on buyer supplier relationships (supplier transparency) and supply chain agility" | 2021 | Indonesia | Telecommunic ations equipment business. | The researcher discovered that the perceived supplier transparency and firm supply chain agility were not significantly impacted by industry 4.0 technology. |
| Schmidt et al | "Industry 4.0 implementation in the supply chain: a review on the evolution of buyer-supplier relationships, International Journal of Production Research DOI: 10.1080/00207543.2022.2120923" | 2022 | Germany | Supply chain | A cooperative culture that supports Industry 4.0 implementation is to be established and the organizational structure is to be adequately shaped for Industry 4.0 implementation across companies. building up trust with suppliers, sharing visions and close cooperation, that is developing Social Capital, are prerequisites for successful long-term BSRs being the fundament of Industry 4.0 in supply chains |
| Burger et al | "Aiming for Industry 4.0 Maturity? The risk of higher digitalization levels in buyer-supplier relationships. DOI:10.1016/j.procir.2021.11.258" | 2021 | - | Logistics and manufacturing | Traditional buyer supplier relationships are transformed through Industry 4.0, especially by improving existing bonds and creating new ties between buyers and suppliers. |

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|---|---|---|---|---|---|
| Maarouf | 'The buyer supplier relationships in industry 4.0" | 2021 | Netherlands | Brake manufacturing | The study indicates that a supplier platform will exist with the intention of enabling unrestricted information exchange between buyers and providers. The procurement department needs to secure the support of the management and integration into the digital strategy, to receive the necessary investments. Additionally, it is essential to develop the right technologies so that the networking process on a larger scale is enabled. |
| Patrucco et al. | Looked on how industry 4.0 boosts collaborations in buyer supplier relationships.DOI:10.1080/08956308.2021.1999131 | 2021 | Florida | Supply chain | The study revealed that although three technologies directly improve supply chain performance, big data analytics, cloud computing and simulation and modeling also fully support collaborative supply chain models, while track and tracing tools create more visible supply chains but are detrimental to obtaining higher process integration with suppliers. |
| Veile et al | "Expected buyer supplier relationships in the era of industryv4.0-an analysis across industry sectors" | 2020 | Germany | All industry sectors | According to the report, organizations are consolidating their supplier base by concentrating on key strategic suppliers, and future transactions will primarily be based on digitalized, automated operations that move diverse value creation processes to platforms. |
| Wakabashayi et al | "Analysis and Suggestion of an e-Commerce Logistics Solution: Effects of Introduction of Cloud Computing Based Warehouse Management System in Japan. DOI https://doi.org/10.1007/978-3-319-07287-6_40" | 2014 | Japan | Clothing industry | Establishing physical stores and creating web-based apparel businesses both require the capacity to swiftly implement and update cutting-edge IT logistics systems. |
| Veile et al | "Relationship follows technology! How Industry 4.0 reshapes future buyer-supplier relationships.DOI:10.1108/JMTM-09-2019-0318" | 2021 | Australia | Automotive, electronics and electrical engineering industries. | The study reveals how expected buyer supplier relationships in various industries differ in comparison to the present situation. In future value creation processes will continue to get digitized and atomized covering all industries. |

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|---|---|---|---|---|---|
| P Sharma | "Cloud Computing for Supply Chain Management and Warehouse Automation: A Case Study of Azure Cloud" | 2023 | India | Retail | The firm can achieve a high-volume ratio and successful picking plans by optimizing labor efficiency in supply chain management and retail warehouse distribution. The businesses ought to simplify their processes. |
| Burger et al | "Digital supplier integration — Transaction 4.0 in buyer-supplier relationships DOI:10.1007/978-3-658-35449-7_10" | 2021 | Netherlands | Logistics | Technology adoption brings about the challenge of choosing a suitable way of integration for each supplier. Although digital supplier integration promises crucial benefits, it is currently not realized in most companies. It lacks a practical guideline that supports firms to integrate suppliers within the best balance between, costs, capabilities, and benefits depending on them supplier strategy. The study proposes the new concept of Transaction 4.0 capabilities for measuring the degree of implementation of Industry 4.0 regarding the exchange of products and information between a buyer and a supplier. |
| Veile et al | "Toward a new era of cooperation: How industrial digital platforms transform business models in Industry 4.0. https: doi.org/10.1016/j.jbusres.2021.11.062" | 2022 | United States and Germany | Industrial marketing | This study reveals that digital platforms transform business models in Industry 4.0 contexts significantly. Although all areas of business models that is value creation, value offering, and value capture are subject to changes, some building blocks are affected more than others. |
| Muller et al | "Prerequisites and Incentives for Digital Information Sharing in Industry 4.0 – An International Comparison across Data Types.DOI:10.1016/j.cie.2020.106733" | 2020 | Germany, China, India, USA | Small and medium sized enterprises. | The study confirms that social capital has a positive effect on collaboration and data exchange. The study also found that social interaction and shared vision have a positive effect on collaboration in the context of Industry 4.0. |
| Oztemel et al | "Literature review of Industry 4.0 and related technologies | 2020 | Turkey | Manufacturing industry | The manufacturing systems will have a different vision composed of products, intelligence, communications and information network adoption of industry 4.0 technologies. There is need to developed technological infrastructure with |

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| | | | | | physical systems, management models in order to reap the full benefits of digital technologies. |
| Raj et al | "Barriers to the adoption of industry 4. 0 technologies in the manufacturing sector: An intercountry …. *Int. J. Prod. Econ."* | 2020 | India | Automotive companies | The article discusses challenges in the adoption of technological innovation in developing countries due to a lack of cohesive national policies on Industry 4.0. This deficiency can hinder firms in fully embracing the industry 4.0 revolution. The absence of coordinated national strategies may impede the diffusion of Industry 4.0 technologies, limiting the potential benefits for businesses in developing countries. This can lead to missed opportunities for firms to leverage the advantages of the industry 4.0 revolution. |
| Kumar et al | "Analysis of Barriers to Industry 4.0 adoption in Manufacturing Organizations: an ISM Approach, Procedia CIRP, Volume 98, 2021, Pages 85-90, ISSN 2212-8271, https://doi.org/10.1016/j.procir.2021.01.010" | 2021 | - | Manufacturing industry | The obstacles identified through an extensive literature review and input from industry experts include poor integration in the value chain, cybersecurity issues, uncertainty regarding economic benefits, inadequate workforce skills, high investment needs, insufficient infrastructure, disruptions in jobs, difficulties in managing and ensuring data quality, absence of secure standards and norms, and resistance to change. The barriers encompass a wide range of factors that hinder the adoption and implementation of new technologies in various industries. |
| Senna et al | "Prioritizing barriers for the adoption of Industry 4.0 technologies. Comput. Ind. Eng. 171, C (Sep 2022). https://doi.org/10.1016/j.cie.2022.108428" | 2022 | Portugal | Manufacturing industry | The research findings indicated that obstacles associated with standardization and absence of readily available solutions are viewed as fundamental barriers. These challenges were identified as key impediments in the study's analysis of the issue. |
| Maisiri et al | "Factors that inhibit sustainable adoption of Industry 4.0 in the South African manufacturing industry. Sustainability, 13(3), 1013". | 2021 | South Africa | Manufacturing | Slow adoption of industry 4.0 technologies was associated with the regulatory framework that impedes timely adjustments to industry norms. This connection highlights the challenges in |

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| | | | | | making quick changes to standards within the industry. |
| Chauhan et al | "Barriers to industry 4.0 adoption and its performance implications: An empirical investigation of emerging economy. Journal of cleaner production, 285, 124809". | 2021 | India | Manufacturing | The study shows that supply chain competency and operational performance are enhanced by Industry 4.0 implementation. To build significance for industry 4.0 implementation in nations, strategies need to be established in partnership with educational institutions, producers, municipal governments, and labor groups. |
| Sayem, et al | "Critical barriers to industry 4.0 adoption in manufacturing organizations and their mitigation strategies. Journal of Manufacturing and Materials Processing, 6(6), 136". | 2022 | France | Manufacturing | Adoption of industry 4.0 technologies is hindered by many challenges such as risk of security breaches and insufficient infrastructure. Also lack of skilled workforce is another adoption barrier. |
| Aggarwa et al | "Evaluation of key challenges to Industry 4.0 in Indian context: A DEMATEL approach, *Advances in Industrial and Production Engineering* (2019), pp. 387–96". | 2019 | India | Production engineering | The endorsement of governmental policies presents a significant obstacle that influences various other challenges such as technological infrastructure and management commitment. |
| Durmaz et al | "Analyzing key barriers to Industry 4.0 for sustainable supply chain management. J. Intell. Fuzzy Syst. 43, 5 (2022), 6663–6682. https://doi.org/10.3233/JIFS-220732" | 2022 | Germany | Supply chain | The results show that adopting Industry 4.0 technologies in the Sustainable Supply Chain is significantly hampered by uncertainty about the economic benefits, resistance to change, and a lack of appropriate infrastructure and tools. The report emphasizes how critical it is to remove these obstacles in order to successfully integrate Industry 4.0 technology within the framework of Sustainable Supply Chain Management. |
| Reis et al | "Industry 4.0 in Manufacturing: Benefits, Barriers and Organizational Factors that Influence its Adoption. doi: 10.1142/S0219877021500437" | 2021 | Brazil | Manufacturing | The results highlighted that lack to technological infrastructure, cyber security concerns and government support were among the barriers that are slowing firms to adopt industry 4.0 technologies. |

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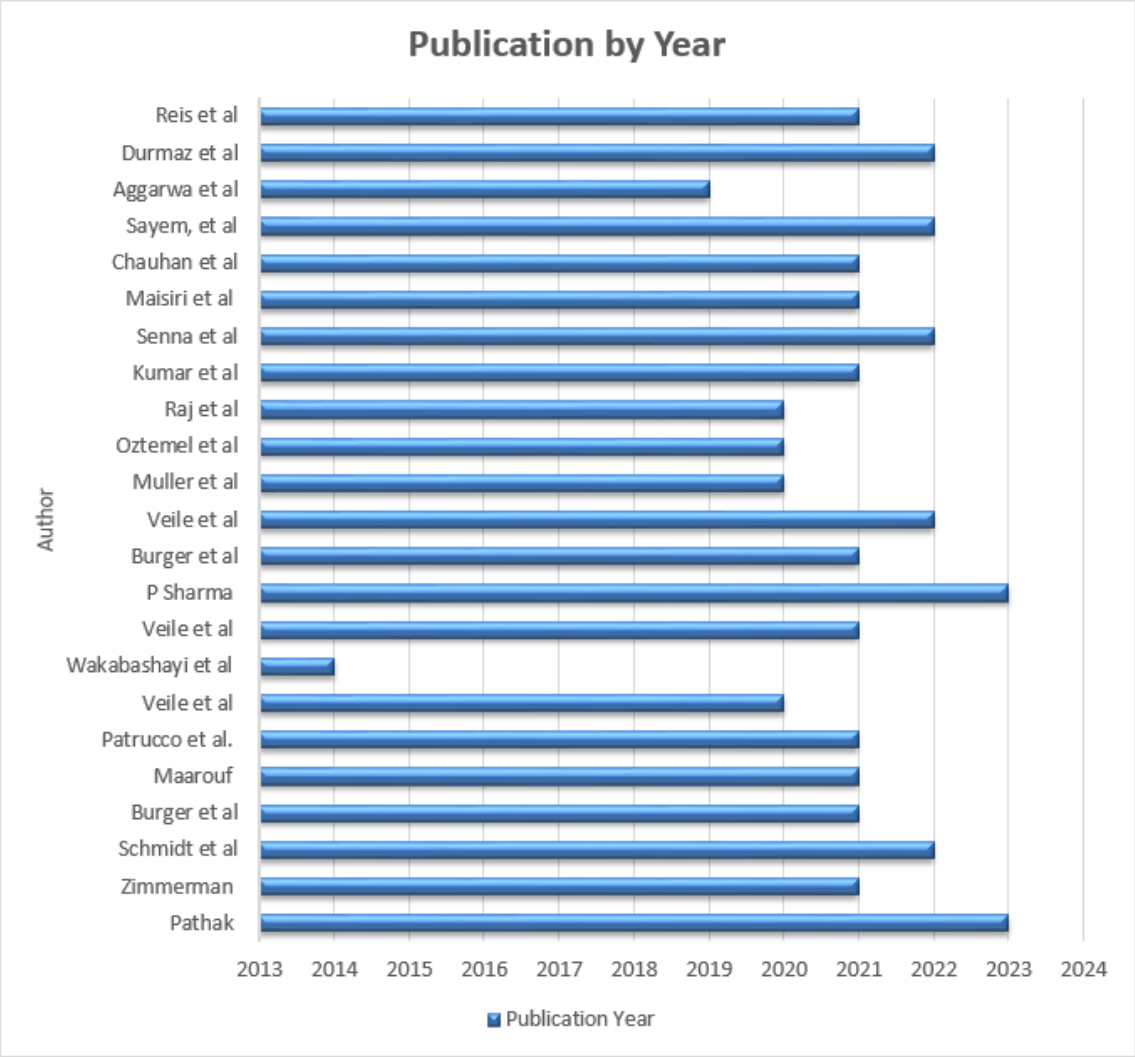


**Figure 1: Article publication year**

Source: Secondary data analysis 2024

Figure 1 depicts the authors and publication years related to the impact of cloud-based warehouse management systems on buyer–supplier relationships, presenting an analysis of research trends in this area. This representation offers insights into the scholarly contributions and temporal evolution of studies in this field. Overall, the figure provides a comprehensive snapshot of the academic landscape surrounding the influence of cloud-based warehouse management systems on buyer–supplier relationships, highlighting key researchers and the timeline of their publications.

Many papers were written between 2020 and 2021, indicating an increase in interest in Industry 4.0 technologies. For example, the studies by Aggarwa et al. (2019) focused on the challenges to Industry 4.0 adoption the diversity in publication years, such as the

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studies by Aggarwa et al. (2019), Pramod (2021) and Sharma (2023), shows that the field has undergone numerous innovations, resulting in various challenges and concerns.

Additionally, the range of publications unsolved challenges to the adoption of these smart technologies. Despite the many advantages brought up by cloud-based warehouse management system, Pathak (2023) and Nida et al. (202) highlighted challenges such as a lack of technological infrastructure, poor systems integration, a lack of management commitment and a lack of financial support.

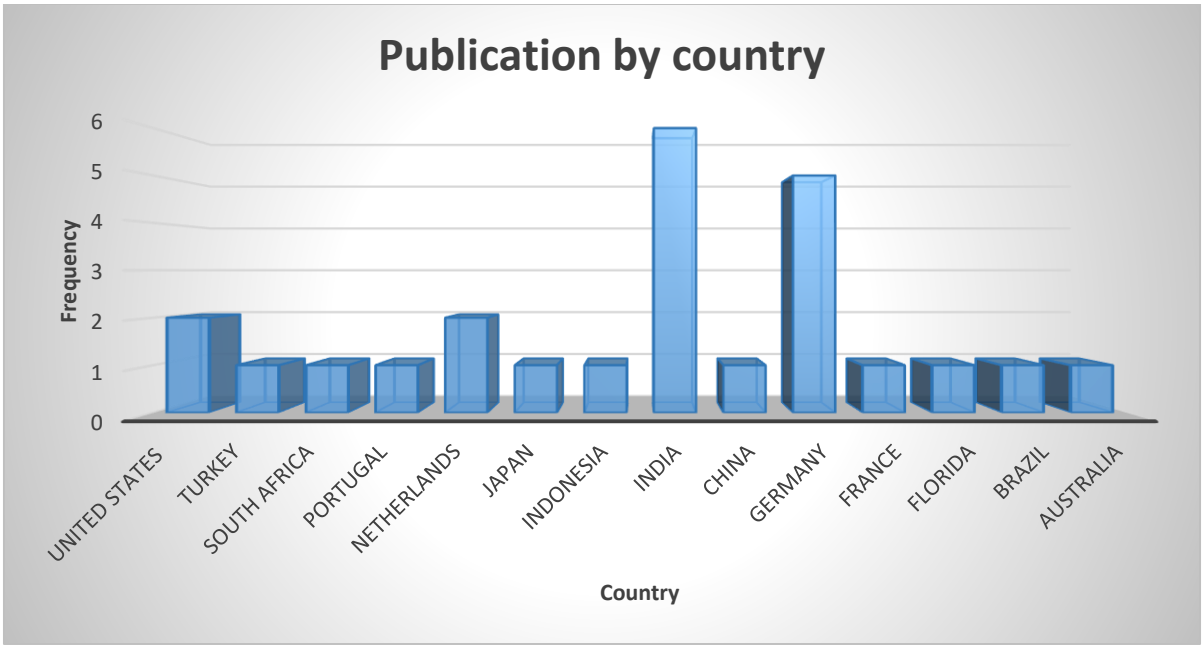


**Figure 2: Publication by country**

Source: Secondary data analysis

Figure 2 above shows the distribution of studies on Cloud-based WMS at the regional level according to the researchers' findings. It therefore provides insight into issues and challenges during the 5-year period. During this period, developing continents, particularly Africa through countries such as India and South Africa, accounted for 28.0%, whereas developed countries, including the U.S., Germany and Netherlands, exhibited significant activity in undertaking research, accounting for 52.0%. The emergence of developing countries is attributed to the appreciation and adoption of technology as a key leverage for their development, whereas developed countries are refining their existing technologies.

Figure 3 below shows studies by industry

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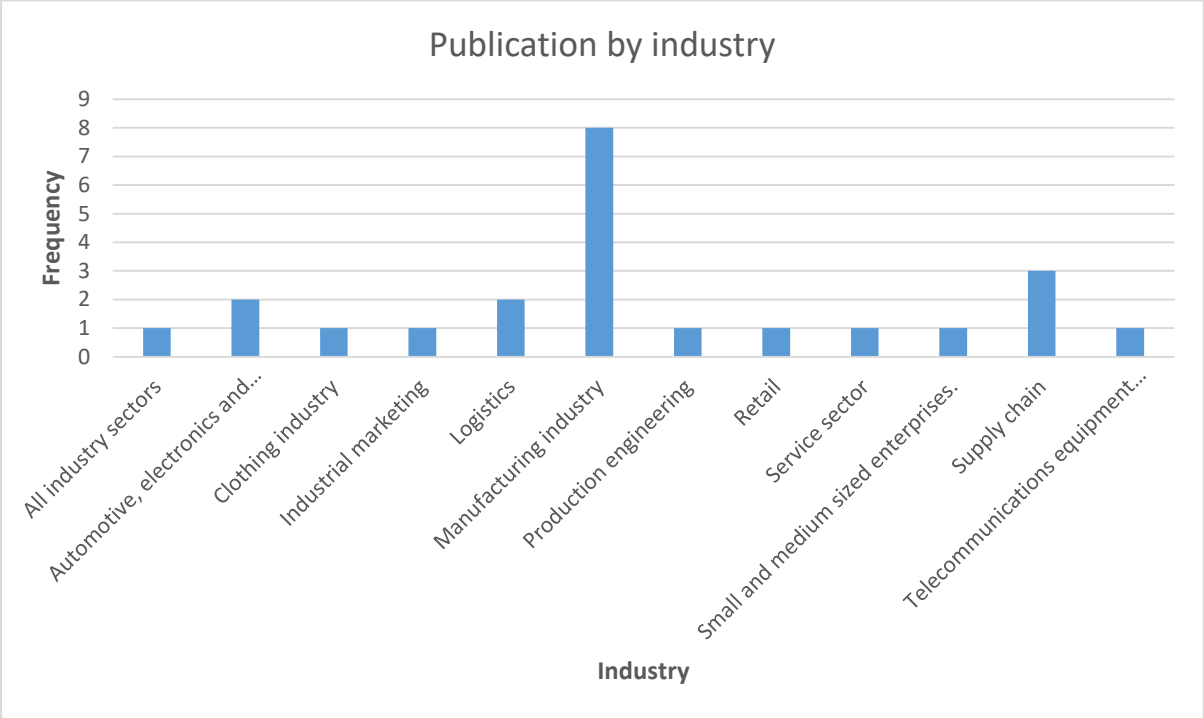


**Figure 3: Publication by industry**

Source: Second data analysis

Figure 3 illustrates distribution of studies across various sectors of the economy. The manufacturing industry accounts for 33% of the studies. This highlights the rate at which cloud-based warehouse management systems are being adopted by manufacturing firms likely driven by continuous changes in manufacturing processes. This requires firms to keep abreast with latest technological trends in order to remain competitive. Supply chain industry with a contribution of 12.5% shows the recognition of benefits of adopting industry 4.0 technologies in creating more responsive supply chains.

Industries such as retail, clothing, production engineering and small to medium enterprises contribute 4% each. This is showing a lower adoption rate of cloud –based warehouse management systems which are likely influenced by lack of technological infrastructure and financial constraints. This calls for partnerships and collaborations among government and stakeholders to promote adoption of these smart technologies. Automotive and logistics industry shows a positive change of 8% which is likely being influenced by need for traceability and visibility by consumers.

## 8. DISCUSSION

According to the data gathered by the author, the study highlights many issues regarding cloud-based WMS adoption and the challenges faced by firms. Most of the studies were undertaken in developed countries, accounting for 52% of the reviewed studies. This can be attributed to well-established technological infrastructure, government support and

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access to advanced technology. Little attention has been given to the textile industry. Developing countries such as South Africa and India account for 28% of the country. However, it is essential to note that there is a need for increased government support, human capital and financial resources in developing countries to keep abreast of the latest trends.

The manufacturing sector had the highest score of studies representing a significant appreciation of the benefits brought about by the adoption of cloud-based warehouse management systems. On the other hand, sectors such as automotive and engineering make moderate contributions. Industrial marketing. Similarly, the service sector, retail sector and small to medium-sized sector make minimum contributions, highlighting the need for more support to promote the adoption of Industry 4.0 technologies and harness their potential to transform business practices.

## 9. RECOMMENDATIONS FOR FUTURE RESEARCH

Future studies should focus on strategies to encourage the adoption of cloud-based methods. In addition, future studies should concentrate on countries that have made few contributions to the literature. Other factors that influence buyer–supplier relationships need to be considered, as they were not addressed by previous studies. This will help to shed light on how buyer–supplier relationships are affected by other factors in addition to Industry 4.0 technologies. Also, there is need to look on how service providers can enhance seamless integration to create connected communities within the cloud. Additionally, researchers can focus on categorization of which service of the cloud (PaaS, IaaS and SaaS) to adopt and at what stage can also be useful for firms to use as a basis for analysis of effectiveness as they will be working towards cloud transformation.

## 10. IMPLICATIONS TO POLICY AND PRACTICE

Before adopting new technologies and methods, it is crucial for managers to understand the dimensions and characteristics of organisational adoption of technological innovation as it is a necessary element in understanding the process. Cloud service providers are essential to an organization's ability to protect its data and maintain privacy. In order to adhere to industry standards and laws, businesses must carefully consider the encryption policies and security measures offered by these providers. By analyzing historical and real-time data, predictive insights help managers to assess demand trends, spot possible disruptions, and manage inventory levels to save costs and avoid stock outs (Jyothilakshmi G Kava et al, 2023). Also, Consistent assessments and monitoring of cloud security protocols ensure ongoing compliance and reduce risks related to data handling and storage. In order to enhance the significance of Industry 4.0 implementation within enterprises, collaborative methods involving many stakeholders, including educational institutions, producers, and governments, must be formed.

When deciding whether to implement cloud computing in their companies, managers can use this study as a basis by comparing their experiences with the study's results and making an educated choice before launching a cloud-based venture

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### 10.1 Implications to theory

The study's theoretical implication stems from its examination of the trade-offs between cloud-based warehouse management systems and buyer supplier relationships using the triple bottom line approach. The relationship will result in enhanced stakeholder relationships and also help researchers to deepen understanding of cloud based warehouse management systems. When academics from different fields work together, they can solve complicated issues in novel ways. Furthermore, it can encourage the exchange of resources and knowledge between various research groups leading to better quality of research outcomes. Continuous empirical research and validation of frameworks are essential in the progress of technology. These activities are necessary to ensure the effectiveness and reliability of new technological developments.

## 11. LIMITATIONS

The study was limited to studies that the author was able to access. Therefore, the conclusions were based on the studies that the author was able to access. Furthermore, no methods were employed to prioritize the obstacles to the adoption of industry 4.0 technology. The literature review was conducted within a restricted time frame. The review's breadth and depth were impacted by this time limit. Furthermore, no actionable recommendations for promoting the usage of cloud-based warehouse management systems were included in the study.

## 12. CONCLUSION

It can be concluded that cloud-based warehouse management systems have benefits and downside risks, as some business functions will have to change to adapt to smart warehousing. Visibility and traceability between firms are enhanced through the integration of suppliers into a cloud-based platform. Collaboration is required with all the suppliers involved in the upstream value creation process to effectively take advantage of the benefits of a digital and linked value chain. Another factor is that there is a need for regulation with respect to data, as the use of cloud computing services can expose users to security concerns such as shared cloud computing services, internal and external threats and inadequate backup.

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