SAJSR

South Asian Journal of Social Review

SAG Publishing

Vol. 1 No. 1 June 2022

SOUTH ASIAN JOURNAL OF SOCIAL REVIEW

(ISSN: 2958-2490)

South Asian Journal of Social Review

(ISSN: 2958-2490)

Frequency: 2 Issues per year

The South Asian Journal of Social Review is a multi- and interdisciplinary peer-reviewed academic research journal serving the broad Social Sciences community. The journal's scope is inclusive: it is open to a theoretical, methodological, quantitative, and qualitative scholarship from all areas within the Social Sciences - defined as the academic disciplines concerned with the study of society, and the relationships between individuals within societies. Submissions are evaluated on their academic rigor and methodological soundness. Together with the support of an international Editorial Board, we are committed to upholding the highest editorial and ethical standards. The SAJSR publishes Original Papers and Review Papers and also features thematic articles.

The journal welcomes research in, and between, the following disciplines:

- Management
- Language & Linguistics
- Law & Criminology
- Migration Studies
- Political Science
- Population Studies
- Race & Ethnic Studies
- Religion
- Sociology
- Social Policy
- Urban Studies
- Anthropology
- Communication & Media
- Cultural Studies
- Demography
- Development Studies
- Education
- Ethics
- Gender Studies
- Human Geography
- Labour Studies

SAG Publishing

South Asian Journal of Social Review

(ISSN: 2958-2490)

Editorial Team

Editorial Advisory Board

SAG Publishing

South Asian Journal of Social Review

(ISSN: 2958-2490)

Editorial Note

I am pleased to introduce the "***South Asian Journal of Social Review***" *(SAJSR)*, a rapid peer-reviewed Journal under SAG Publishing. We have been started in the year 2022 and are growing continuously. We are pleased to announce that our first issue has been published online on time. All published articles in this journal are included in the indexing and abstracting coverage of various scientific databases. The submissions to the journal are subjected to the peer review process by the editorial board members or external subject experts. The complete editorial processing of the manuscript is done through the SAG Publishing submission system for greater transparency and faster article throughout. During this calendar year 2022, Editorial Board and Advisory Board comprise prominent expert Editors and Reviewers who joined *SAJSR* and contributed their valuable services to the journal's quality.

I would like to express my gratitude to all the authors, reviewers, the SAG publishing, Assistant Editors, and the Editorial Board of *SAJSR*. With their support, we have released Vol. 1 and Issue for the calendar year 2022. This is the first issue in Vol. 1, and we look forward to bringing out the next issue in December.

Dr. Rizwana Rasheed
Editor
South Asian Journal of Social Review (SAJSR)
(ISSN: 2958-2490)
Email: editor@sagpb.com
Website: www.journal.sagpb.com

Indexing and Listing

SAG Publishing

South Asian Journal of Social Review

(ISSN: 2958-2490)

Table of Contents

South Asian Journal of Social Review
2022 Vol. 1, No. 1, pp.1-7
DOI: 10.57044/SAJSR.2022.1.1.2201

Climate-Smart Agricultural Practices at Oyo State-Nigeria

Gbadebo Olubukola Victory[1*]
Oyewole, Adekemi Lizzie[2]
Ahmed Ahmed Olaitan[3]

[1, 2] Federal College of Forestry, Ibadan, Oyo State, Nigeria
*[*3] Forestry Research Institute of Nigeria Ibadan, Nigeria*

**Corresponding Author Email: adeayomi19@gmail.com*

Article History

Received: 15 June 2022
Revised: 25 June 2022
Accepted: 28 June 2022
Published: 30 June 2022

JEL Classification:
Q00
Q13
Q16
Q54

ABSTRACT

Climate-smart agricultural practices have been recognized to increase agricultural yield and enhance sustainable food production sustainably. This study examined the climate-smart agricultural practices used by cassava farmers and assessed the benefits obtained from using the climate-smart practices in the study area. The study adopted a two-stage sampling procedure in selecting 120 registered cassava farmers for questionnaire administration. Percentages, frequencies and chi-square were used to analyze the data. 96.8% of the farmers are male and above 60 years of age (41.7%) with household sizes of 5-8. Results indicate that 100% of respondents currently use and adopt different climate-smart agricultural practices for cassava production. Most cassava farmers derived enhanced benefits from using and adopting climate-smart agricultural practices. The chi-square analysis further revealed that the selected socio-economic profile of the respondents, such as education, farming experience, and size of farmland, significantly determined and influenced farmers' usage and adoption of climate-smart agricultural practices. Based on the discoveries from this study, extension officers and relevant agencies should develop suitable policies that will encourage farmers to adopt climate-smart agricultural practices.

Keywords: *Adoption, Cassava Production, Agricultural Smart Practices, Climate Change, Southwest*

Citation of this article:

Victory, G. O., Lizzie, O. A. & Olaitan, A. A. (2022). Climate-Smart Agricultural Practices at Oyo State-Nigeria. *South Asian Journal of Social Review, 1*(1), 1-7. https://doi.org/10.57044/SAJSR.2022.1.1.2201

Climate-Smart Agricultural Practices at Oyo State-Nigeria

1. Introduction

One of the most significant problems facing sub-Saharan African countries is climate change (Ozor et al., 2015). Climate change is a significant threat in the Sub-Saharan African region attributable to its dependence on climate-related sectors like agriculture (Solomon et al., 2007). It has stimulated discourses concerning the causes' long-term effects and how to forestall its prolonged and frustrating impacts. Climate change, according to Intergovernmental Panel on Climate Change (Solomon et al., 2007), refers to the state of the climate that can be identified by variability in the mean of its properties (average temperature, wind and rainfall patterns) that persists for an extended period due to natural changes or as a result of human activities. Therefore, climate change can be fundamentally summarized as a long-term alteration in global temperature, precipitation, wind patterns and other indicators of climate that occurs over time. These changes have significant negative impacts on food security and crop production. Its impacts, such as decreased agricultural yield, high evaporation rates, reduced soil nutrients and low income, in combination with other weather variability indicators such as rising temperature and declining rainfall, could result in a reduction in agricultural productivity (Adebayo, 2010).

Agriculture remains a fundamental part of the Nigerian economy, contributing over 40% to the country's GDP and sustaining the food needs of its population (FMAWR, 2007). Sub-Saharan African countries like Nigeria, which relies on the weather-related agricultural system, are exposed and very susceptible to the effects of weather destabilization (Aid, 2008). Reports from Harris and Consulting (2014) have shown that variability in weather conditions in the sub-Saharan region reduces cropping season, reduces yield and disrupts the cropping calendar. These and many more make food production more challenging. Hence, the need for an enhanced and sustainable food production mechanism in Nigeria is pivotal.

According to the United Nations (2017), Nigeria's population growth is projected to increase to 263 million by 2030. Besides, agricultural sustainability necessitates a notable modification to ensure sufficient food supply to meet the needs of the people (Kaczanet al., 2013). However, it calls for adopting an environmental-friendly practice that ameliorates the consequences of weather variability on agricultural production. Based on this, Climate-Smart Agricultural Practice (CSAP), therefore, becomes a vital tool that enhances sustainable agricultural production. Climate Smart Agricultural Practice (CSAP), according to (Lipper, 2014), is an agricultural practice or technology that sustainably increases food production, increases adaptability, reduces and removes pollutants from the atmosphere and intensifies the attainment of national food security goals. Thus, CSAP is an age-long, ingenious agricultural mechanism that promotes increased agricultural production and income for sustained food security and enhances mitigation of climate change impact. This practice and approach focus on improving crop production, which involves using fertilizers, adopting agroforestry practices, using improved cassava varieties, planting cover crops, intercropping cassava with yam/maize etc. (Campbell et al., 2014).

Cassava is an essential aspect of agricultural production in Oyo State, Nigeria. It is irrefutably a popular staple crop cultivated throughout the year due to its capacity to boost the economic status of farmers and enhance their livelihood (Kehinde & Subuola, 2015). The relevance of this staple crop indwells in its diverse capacity as a by-product to be transformed into several other secondary products. Despite this, cassava production in the rainforest agro-ecological zone of the country is affected by variability in weather-related indicators, which leads to low cassava yield and low income (Adejuwon & Odekunle, 2006). Despite the rising concern at international policy levels and national organizations about the sustainability of agricultural development and food security in developing countries, farmers still find it challenging to use and adopt CSAP appropriately. A report by Lipper (2014) revealed that rural farmers lack awareness and knowledge of the usage of these practices.

Adopting CSAP can be viewed as a process whereby farmers fully utilize environmental-friendly agricultural mechanisms as the only best option. Adoption as a process follows a sequence of five stages: awareness—interest—evaluation—trial- adoption. However, it does not always follow this sequence in practice since interest/willingness may precede awareness. The level of adoption of CSAP may vary across societies, individuals and households. The adoption of CSAP by cassava farmers' can increase their climate-adaptation skills, improve agricultural yields, curtail environmental depletion and enhance food security goals.

Mitigating the challenges confronting sustainable cassava production is very important for sustainable livelihood. Hence, the study examined the adoption of climate-smart agricultural practices by cassava farmers of Oyo State, with the following objectives: to identify the summary statistics of the sampled farmers, to examine respondents' level of awareness of climate-smart agricultural practices, assess the climate-smart agricultural practices adopted by respondents, determine the level of adoption, identify the constraints to adoption of CSAP and finally investigate the factors that determine the adoption of CSAP.

2. Materials and Methods

2.1 Study Area

IDO LGA, the study area, is located in Oyo State. It is positioned between longitude 3047′ 34.99″E and latitude 9030′ 44.49″N occupying a land area of 986km with a projected population of 174,826 as of 2020 using the population growth rate of the area (National Population Commission, 2006). It is located in the forest belt zone with an average daily temperature ranging between 25 °C and 35 °C throughout the year. Rainfall is about 1800mm annually. The LGA is highly endowed with fertile agricultural land suitable for farming activities. Residents in the LGA are primarily small-scale farmers engaged in other income-generating activities such as trading, artisanship and hunting.

2.2 Sampling Procedure and Data Analysis

The study adopted a two-stage sampling procedure in selecting one hundred and twenty cassava farmers who were registered with Government. Six out of ten political wards were selected for the first stage. For the second stage, twelve villages were randomly chosen from the political wards, out of which ten registered cassavas farmers were chosen from each of the villages for questionnaire administration (Baloch & Rashid, 2022; Hashmi et al., 2020; Hashmi et al., 2021; Rashid et al., 2021).

Data was obtained through the use of a close-ended questionnaire to evaluate the summary statistics of selected variables, examine respondents' level of awareness of climate-smart agricultural practices, assess the climate-smart agricultural practices adopted by respondents, determine the level of adoption, identify the constraints to adoption of CSAP and finally investigate the factors that determine the adoption of climate-smart agricultural practices.

3. Results and Discussions

From the result in Table 1, many (41.7%) of the respondents are within the cohort of 60yrs and above. This indicates that the older population is actively involved in farming activities. A more significant percentage (96.8%) of farmers in the study area are male, while a few (4.2%) are females. This shows that gender dominance is connected with the nature of the job. The majority (40.0%) of the farmers' had primary Education, (28.3%) had secondary Education and only (31.7%) had tertiary Education. This indicates that most of the respondents have attained a significant literacy level (Shaheen, 2022).

Findings also revealed that the majority of the respondents (88.3%) practice farming as an occupation. This is because farming is the primary means of sustenance for rural dwellers, which

contributes to rural development and means of livelihood. Most cassava farmers' (70.8%)have farming experience of 16 years and above. The extent of farming experience, according to Ayanlade (2009), indicates a higher utilization and adoption of CSAP since the farmers are knowledgeable about past and present climatic conditions.

Table 1: Summary of socio-economic characteristics statistics of the sampled farmers

Variables	Frequency	Percentage (%)
Age Group (yrs)		
20-29	1	0.8
30-39	30	25.0
40-49	26	21.7
50-59	13	10.8
60 and above	50	41.7
Gender		
Male	115	96.8
Female	5	4.2
Education Status		
Primary	34	28.3
Secondary	48	40.0
Tertiary	38	31.7
Farming Experience (yrs)		
1-5	5	4.2
6-10	7	5.8
11-15	23	19.2
16 and above	85	70.8
Primary Occupation		
Trading	14	11.7
Farming	10	88.3
Size of Farmland (acres)		
< 1	84	70.0
1 – 2	24	20.0
3 – 4	12	10.0

Source: Field survey (2022)

3.1 Perception of Cassava Farmers on Climate Smart Agricultural Practices

Half (50%) of the respondents perceive climate change to be variability in rainfall patterns, (and 8%) consider it as changes in wind patterns, while (17%) regard it as an increase in temperature. Nzeadibe et al. (2011) observed that the most basic understanding of climate change is an alteration in weather-related conditions. Of the respondents, a minimal figure (10%) perceive drought as a climatic parameter, while (15%) of the respondents regard frequent flooding as climate change.

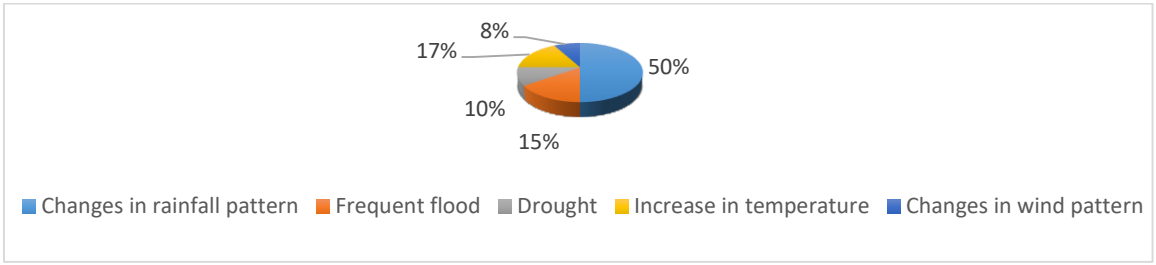


Figure 1: Perception of cassava farmers on climate change

3.2 Climate Smart Agricultural Practices Used and Adopted by Farmers

The entire (100%) respondents investigated practiced early and late planting methods as a climate-smart strategy. This indicates cassava farmers adjust their work calendars to suit their farming operations. Ayanlade et al. (2018) affirmed that smallholder farmers plant only when there is steady rainfall rather than planting at the start of the farming season. Most (91.7%) of the farmers use improved cassava varieties, (97.5%) use fertilizer to improve soil health and (97.5%) practice mulching techniques. Most (94.2%) of the cassava farmers use irrigation facilities during drought periods that

sometimes emerge in the middle of the planting season. This confirms the report of Ajao and Ogunniyi (2011) that farmers often use irrigation as a strategy to mitigate climate change. The majority (97.5%) of the respondents practiced mixed cropping by planting other foods crops like yam, maize and vegetables, (57.5%) practiced agroforestry and (95.0%) planted cover crops. This supports the findings of Adedire (2010), who affirmed that agroforestry is a classical climate-smart agricultural strategy that improves sustainable food production by incorporating trees and shrubs on farms since they absorb more carbon than crops.

Table 2: Distribution Based on Climate Smart Agricultural Practices Used and Adopted on Cassava Farms

Climate Smart Practices	Highly Adopted (%)	Not Adopted (%)
Early and late planting methods to suit the onset of rainfall	120 (100.0)	-
Use of improved cassava varieties	110 (91.7)	10 (8.3)
Manure/Fertilizer application to improve soil health	117 (97.5)	3 (2.5)
Use of Irrigation facilities during drought season	113 (94.2)	7 (5.8)
Use of mulching techniques	117 (97.5)	3 (2.5)
Agroforestry practices	69 (57.5)	51 (42.5)
Intercropping cassava with yam, maize and vegetables	117 (97.5)	3 (2.5)
Planting of cover crops	114 (95.0)	6 (5.0)

Source: Field survey (2022)

3.3 Benefits Obtained from Using and Adopting CSAP

The result (99%) obtained a higher benefit through increased agricultural output, which ranked highest (2.50). The cassava farmers affirmed that they obtained high benefits like; increased income (2.48), increased food production (2.40) and enhanced pest management (2.39), which ranked 2nd, third and fourth. Other benefits obtained are proper farm planning (2.37) and improved soil health (2.22), ranking fifth and sixth. This is an indication that cassava farmers obtain significant benefits from using CSAP.

Table 3: Distribution based on Benefits Obtained from Using and Adopting CSAP

Benefits	Larger Extent	Lesser Extent	Not at All	Mean	Rank
Increased crop yield	99 (82.5)	16 (13.3)	5 (4.2)	2.50	1st
Increased income	97 (80.8)	13 (10.8)	10 (8.4)	2.48	2nd
Enhanced pest management	90 (75.0)	21 (17.5)	9(7.5)	2.39	4th
Proper farm planning	84 (70.0)	29 (24.2)	7 (5.8)	2.37	5th
Improved soil health	81 (67.5)	24 (20.0)	15 (12.5)	2.22	6th
Increased food production	75 (62.5)	31 (25.8)	14 (11.7)	2.40	3rd

Source: Field survey (2022)

The chi-square summary further revealed three characteristic variables such as; the size of farmland (x^2=29.726, p=0.013), farming experience (x^2=62.732, p=0.000), and Education (x^2=25.810, p=0.000) significantly determined and influenced farmers' usage and adoption of CSP. This implies that cassava farmers with higher educational qualifications, higher farming experience, and large farm sizes are more likely to use and adopt CSAP. Ayanlade (2009) observed that extent of farming experience and Education were statistically significant with the use and adoption of CSAP since the farmers are knowledgeable about past and present climatic conditions. However, age and sex have no significant relationship with the use and adoption of CSAP.

Table 4 Chi-Square Summary of Selected Characteristic Variables and Respondents' Adoption of CSAP

Variables	Chi-square value	P-value	Decision
Age	16.276	0.179	Not Significant
Sex	3.911	0.271	Not Significant
Education	25.810	0.000	Significant
Farming experience	62.732	0.000	Significant
Size of farmland (acres)	29.726	0.013	Significant

4. Conclusion and Recommendation

Based on the findings of this study, cassava farmers obtained great and sustainable benefits from the usage/adoption of CSAP. Education, farming experience and size of farmland significantly determined and influenced the use of climate-smart agricultural practices. The study, therefore, concludes that CSAP is beneficial for increasing yield, income and sustainable food production. Extension officers and relevant agencies should develop policies encouraging farmers to adopt climate-smart agricultural practices.

References

Adebayo. A. A. (2010). Climatic change impact on Education. Vunoklang Multidisciplinary. Journal of Science and Technology Education, 1(1),6-11.

Adedire, M. O. (2010). Agroforestry and climate change Mitigation. In Proc. 2nd Biennial National Conference of the Forests and Forest Products Society, 26th-29th April (pp. 252-260).

Adejuwon, J. O. & Odekunle, T. O. (2006). Variability and Severity of the Little Dry season in Southwest Nigeria. Journal of Climate, 19(3), 483-493. https://doi.org/10.1175/JCLI3642.1

Aid, A. (2008). The time is now. Lesson from farmers to adapting to Climate Change.

Ajao, A. O., & Ogunniyi, L. T. (2011). Farmers' strategies for adapting to climate change in Ogbomoso agricultural zone of Oyo state. Agris on-line Papers in Economics and Informatics, 3(665-2016-44832), 3-13.

Ayanlade, A. (2009). Seasonal rainfall variability in guinea savannah part of Nigeria: A GIS approach. International Journal of Climate Change Strategies and Management, 1(3), 282-296. https://doi.org/10.1108/17568690910977492

Ayanlade, A., Radeny, M., Morton, J. F. & Muchaba, T. (2018). Rainfall variability and drought characteristics in two agro-climatic zones: An assessment of climate change challenges in Africa. Science of the Total Environment, 6(30), 728-737. https://doi.org/10.1016/j.scitotenv.2018.02.196

Baloch, N. & Rashid, A. (2022). Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis. South Asian Journal of Operations and Logistics, 1(1), 1-13. https://doi.org/10.57044/SAJOL.2022.1.1.2202

Campbell, B. M., Thornton, P., Zougmoré, R., Van Asten, P., & Lipper, L. (2014). Sustainable intensification: What is its role in climate smart agriculture?. Current Opinion in Environmental Sustainability, 8, 39-43. https://doi.org/10.1016/j.cosust.2014.07.002

FMAWR, (2007). Federal Ministry of Agriculture and Water Resources - National Programme for Food Security, FMAWR, Abuja, Nigeria, pp. 107. Available at: https://documents1.worldbank.org/curated/en/468971468100478505/pdf/E17890v10Box0321448B0CADP1PMP1final.pdf.

Harris, T., & Consulting, T. H. (2014). Africa agriculture status report 2014: Climate change and smallholder agriculture in Sub-Saharan Africa (No. BOOK). Alliance for a Green Revolution in Africa (AGRA).

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020). Mediating effect of integrated systems on the relationship between supply chain management practices and public healthcare performance: Structural Equation Modeling. *International Journal of Management and Sustainability*, *9*(3), 148-160. https://doi.org/10.18488/journal.11.2020.93.148.160

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021). Mediation of inventory control practices in

proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management. 9*(1), 89-98. https://doi.org/10.5267/j.uscm.2020.11.006

Kaczan, D., Arslan, A. & Lipper, L. (2013). Climate-Smart Agriculture? A review of current practice of agroforestry andconservation agriculture in Malawi and Zambia, *ESA Working Paper*, 13-07.

Kehinde, A. T., & Subuola B. F., (2015). Women and Cassava Processing in Nigeria. International *Journal of Development Research, 5*, 3513-3517.

Lipper, L., Thornton, P., Campbell, B. M., Baedeker, T., Braimoh, A., Bwalya, M., ... & Torquebiau, E. F. (2014). Climate-smart agriculture for food security. *Nature climate change*, *4*(12), 1068-1072. https://doi.org/10.1038/nclimate2437

National Population Commission. (2006). *National population and housing survey*. National Population Commission, Abuja, Nigeria.

Nzeadibe, T. C., Egbule, C. L., Chukwuone, N. A., & Agu, V. C. (2011). Climate change awareness and adaptation in the Niger Delta Region of Nigeria. *African Technology Policy Studies Network Working Paper Series, 57*, 1-30.

Ozor, N., Umunakwe, P. C., Ani, A. O., & Nnadi, F. N. (2015). Perceived impacts of climate change among rural farmers in Imo State, Nigeria. *African Journal of Agricultural Research*, *10*(14), 1756-1764. https://doi.org/10.5897/AJAR2015.9618

Rashid, A., Rasheed, R., Amirah, N. A., Yusof, Y., Khan, S., & Agha, A., A. (2021). A Quantitative Perspective of Systematic Research: Easy and Step-by-Step Initial Guidelines. *Turkish Online Journal of Qualitative Inquiry*, *12*(9), 2874-2883.

Shaheen, S. (2022). Quality management and operational performance: a case study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 14-19. https://doi.org/10.57044/SAJOL.2022.1.1.2201

Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K., ... & Miller, H. (2007). IPCC fourth assessment report (AR4). Climate change, 374.

United Nations. (2017). United Nations, Department of Economic and Social Affairs, Population Division. World population prospects: The 2017 revision, key findings and advance tables.

South Asian Journal of Social Review
2022 Vol. 1, No. 1, pp. 8-20
DOI: 10.57044/SAJSR.2022.1.1.2202

Supply Chain Visibility in Leading Organizations of the Shipping Industry

Muhammad Hunaid[1*] *[*1,2,3] Researcher, Department of Business Administration, Iqra University, Karachi, Pakistan*
Araib Ahmed Bhurgri[2] **Corresponding Author Email: muhammadhunaid20@gmail.com*
Asad Shaikh[3]

Article History

Received: 20 April 2022
Revised: 28 June 2022
Accepted: 29 June 2022
Published: 30 June 2022

JEL Classification
R14
N75
L60

ABSTRACT

It has been acknowledged that SC visibility is the driving force for the customers to fulfil their needs in today's world. In this research paper, the researchers aim to examine different factors impacting SC Visibility. Supply chain issues are bringing attention to a sector that has generated concern about healthy competition, worker welfare, and environmental damage for years. SC visibility factors need to be quantified because they provide clients with the data; they need to better estimate demand, ensuring they do not run out of anything during busy or lean periods. The study is based on an extensive literature review and responses from leading supply chain management consulting firms. To identify technology used in supply chain integration, one of the tools for SC visibility can cover all items and assets across extensive supply networks. Freight visibility is essential as shippers' interest in the safe and secure passage of products has proliferated. The population of this research is Employees who are working in the shipping industries and 3pl industries. The paper demonstrates the shipping line to find supply chain visibility. Interest in supply chain integration and analytic integration are primary factors because container logistics management provides direct support to vessel logistics. Their involvement in freight logistics remains unclear and uncertain.

Keywords: *Supply chain management, Logistics, Visibility, Shipping, Integration, Organization*

Citation of this article:

Hunaid, M., Bhurgri, A. A., & Shaikh, A. (2022). Supply Chain Visibility in Leading Organizations of the Shipping Industry. *South Asian Journal of Social Review, 1*(1), 8-20. https://doi.org/10.57044/SAJSR.2022.1.1.2202

Supply Chain Visibility in Leading Organizations of the Shipping Industry

1. Introduction

It turned out to be on the priority list of the supply chain officials as long as there is supply chain visibility is the step to success. Saving money, improving turns, increasing client satisfaction, reducing threat, strengthening compliance, consolidating transportation, and allowing agility & flexibility are just a few of the advantages of visibility. Not long ago, several cargo movers faced many problems connecting those points. The research aim is to study and describe those factors that lack customer visibility. In this chapter, we will consider Freight forwarding units of the shipping industry and how they are facing trouble in gaining visibility. Moreover, this research will include SC integration and its internal operations with an analytic approach. Supply chain issues are bringing attention to a shipping sector that has generated concern about healthy competition, worker welfare, and environmental damage for years. Shipping businesses are at a crossroads. They can adapt to a world requiring larger ports, more warehousing and distribution facilities, and more low-carbon ships. What they decide will almost certainly determine how the global economy reacts to the next world crisis. "The only way to have visibility over items and assets across extensive supply networks, as well as the capacity to act quickly on them, is through technology. The solution to increasing supply chain visibility is straightforward: clever solutions and smart technology". "Controlled access to exact, ideal, and complete occasions & data exchanges, content & basic supply chain data-inside and among the organizations and services running its networks for as long as supply chains have existed." is the ultimate goal of starting to end supply chain visibility.

Supply chain visibility in the shipping industries of Pakistan is no longer the best-kept supply chain secret; it is an absolute necessity. It has been and keeps on being a high-need region for supply chain professionals to invest. Freight visibility is growing more critical as shippers' interest in the safe and secure passage of products has grown to satisfy their customers' critical on-time delivery KPIs. SCH is defined as the "capture and analysis of supply chain information that helps in decision-making, diminishing risk factors, and increase in processes" or "the capability to be notified to exceptions in supply chain execution" (Caridi et al., 2014). SCV offers considerable cost and time savings benefits due to process synchronization (Caridi et al., 2014). For decades, the freight sector has been working to build a real-time information flow on the whereabouts of carried goods. Unneeded delays and wait periods, duties inflicted by clients for deferral, pointless important consignments for things mentioned by clients, and stock decrease are entirely brought about by an absence of or confined situational alertness among the numerous shareholders occupied with supply and logistic operations (Prajogo & Olhager, 2012; Urciuoli & Hintsa, 2018; Caridi et al., 2014). However, the information that carriers presently provide is out-of-date and erroneous, and it is only provided whenever the cargo hits particular milestones. The fundamental notion of freight visibility is based on carrier-dependent milestone-based data, which leaves shippers vulnerable in logistics. Between the checkpoints, organizations lack visibility into their inventory, whether carriers are providing the appropriate service levels, and where supply chain bottlenecks and inefficiencies exist. Supply chains can only acquire a component of the picture of cargo's locations and status if they do not have a comprehensive picture, which limits their capacity to optimize operations.

Supply chain visibility is a metric that can be used to assess the efficacy of a method (McIntyre, 2014). The dependability of worldwide supply chains straightforwardly affects business execution for cargo movers. The convenient appearance of products is imperative to keeping up with supply volumes for each industry. Freight forwarding business in the shipping industry is dynamic and complex; maintaining effective, productive, and adaptable operations requires technology. Shippers, cargo owners, brokers, carriers, or 3PLs can benefit from a new business model that combines real-time tracking with big data analytics. The combination helps them to forecast when fresh shipments should be scheduled and where they should focus future business. Supply chain visibility gives clients the data they need to better estimate demand, ensuring they do not run out of anything during busy or lean

periods. Visibility empowers customers to see where the items are, whether they are at risk while in transit, and follow shipments or transactions as they pass through each critical point. Therefore, transparency in the supply chain is the basis that will enable supply chain managers to keep their clients up to date with the necessary information and earn their trust in achieving a high score at the end of the year. As a result, having a comprehensive perspective of activities inside a company's supply chain network will lead to additional possibilities and more profit. Moreover, with the help of integrated operations and maintaining KPIs, completing every task within their settled time limits can make work efficient. Eventually, it helps create bonding between the clients to have trust. It also makes the business grow.

Lack of visibility is not a new challenge in the shipping world, but beyond doubt, it is an issue that is getting worse daily. As long as the global supply chain grows, there are more ships, cargo, lanes, destinations and ports to track, making shipping data extremely complex and reducing visibility into the shipments. Poor visibility into the supply chain operations brings very different sets of challenges. From poor customer experience and inaccurate KPIs to growing transportation risks, lack of real-time visibility into shipment and forecast demand, if not full fill, will create a bad reputation for the customer, which causes organizations not to do business in future. Furthermore, roughly a fifth of businesses see visibility as one of their top operating challenges (it ranks the third highest priority overall). In response to the fact that digital transformation is a significant driving factor in the evolution of contemporary supply chains, only around half of the organizations have made a plan to manage that change. Core logistics operations, such as moving goods or cargo in transit, in-plant logistics activities, delivery vehicle movement from warehouses to hubs to customers' doorsteps, and truck movement from manufacturers to end customers, are not entirely transparent, accessible, and traceable to the customers. Therefore, it becomes a big challenge for the shipping industries as there is a massive competition in the market and today's world visibility is the crucial part of supply chain operations.

1.1 Research Objective

The research is about finding factors which impact overall Supply chain visibility. Regardless of the information, SC visibility is necessary for the supply chain. However, companies are unsuccessful in attempting to provide supply chain visibility. The research aim is to provide a pool of information regarding factors impacting the overall supply chain visibility. So the companies could focus on those factors in search of possibilities for improvements to enhance success to provide supply chain visibility to their valuable customers in the competitive market.

1.2 Research Questions

Based on the problem statement and the research objectives, the following research questions will seek to find out the outcomes:

1. What problems are being faced in different integrated operations by shipping organizations?
2. What difficulties face organizations in maintaining internal KPIs?
3. What problems does an organization face in overall analytic integration?
4. How does Forecast in operations cause poor visibility?

2.1 Literature Review

There is much study on SCM in the service industries, particularly in healthcare and education (Ang & Griffin, 2008; Parker & DelLay, 2008). The performance of supply chains in 3PLs has been investigated over three business lines: freight forwarding, air and sea transportation, and logistics services. The performance differed dramatically between lines (Lai et al., 2004). Data, information, and systems are the foundations of integration, and they assist in delivering the required results at each level of the supply chain. (Poulymenakou & Tsironis, 2003) According to standard management, which closes the loop in SCM function within overall management, currently, information at different stages of operations influences the quality of a service or product (Poulymenakou & Tsironis, 2003). The

reality that there are variations in the level of supply chain visibility and information dissemination between participants in a supply chain is referred to as transparency. (Lamming et al., 2001).

Increasing the amount of data available in the supply chain creates the appearance of visibility. As a result, coordinating bits of knowledge from analysis to strategy might add to a firm's problem. A supply chain's visibility is critical for accuracy & timely data transmission. The more accurate the information, the higher the transparency; however, the larger the obscurity, the more the information deteriorates. The concept of visibility has been misunderstood in the literature, and it has been used interchangeably with the concept of information transmission (Swaminathan & Tayur, 2003). Several authors have suggested that visibility has advantages, including (1) further developed responsiveness (Patterson et al., 2003); (2) further developed preparation and recharging capacities (Mentzer et al., 2004); and (3) further developed direction. The performance measures are used to check and manage the business's overall operations. They are also used to evaluate and compare the performance of different organizations in the industry, plants, departments, teams and individuals (Mapes et al., 1997; Morran et al., 2009). Most companies evaluate their performances by allocating the indicators to individual processes.

2.1.2 Supply Chain Integration and SC Visibility

Integration is the process of binding people together with a system and process on a common platform. It is a starting point to start collaborating in a supply chain environment. The Source of any visibility solution is the information and the collected data from different integrated paths in the supply chain. Some organizations have adopted a highly digitized environment using EDI, simplifying data transfer. Others may rely on low-tech using excel spreadsheets and email communications. The key to effective supply chain integration towards visibility is connecting these systems and non-systems using different communication approaches and data formats. Visibility has been examined for a long time there is a need for direction to operationalize this phenomenon in complicated supply chains (Wycislak, 2021), Supply chain connection and information exchange are two essential tools in the development of supply chain visibility (Dubey et al., 2018), It represents two types of supply chain visibility research: 1) data technology means receiving and disseminating information among SC members; 2) supply chain visibility as a result of information sharing (Somapa, Cools & Dullaert, 2018). Integration is defined as the degree to which many parties collaborate to create mutually acceptable results. Supply chain reconciliation/integration refers to interior and external coordination systems as organizational processes that ought to be enhanced and incorporated (Kahn & Mentzer, 1998; Romano, 2003).

2.1.3 Analytic Integration and SC Visibility

The fact is that supply chain enterprises must widen their "supply chain knowledge," and "not knowing" is becoming increasingly unacceptable — especially as customers become more empowered with "ubiquitous visibility". Supply chain analytics means utilizing analytical techniques & applications to help decision-taking & at last, upgrade supply chain execution. It is not about knowing what a company knows versus not knowing what a company knows; it is also about getting information to key decision makers when and how they need it (Ellis et al., 2015). Current supply chain management must evaluate various types and stages of analytic methods used by every individual working on different operation parts. With an emphasis on the planning function, the analytic program concentrated on inquiry, reporting, and analysis (Ellis et al., 2015). Organizations likewise look for straightforwardness to further develop coordinated effort and correspondence among trading partners. To arrive at this point, organizations are utilizing new and existing innovation and examination capacities to painstakingly screen and dissect two of them, upstream and downstream supply chain tasks, gain straightforwardness & settle on taught decisions of their inward. Outside supply chain rehearses. Organizations have utilized different kinds of supply chain investigation (SCA) for quite some time to better their data handling abilities and supply chain activities.

2.1.4 Developing KPIs and SC Visibility

Key Performance Indicators, or KPIs, are tools used to analyze the value or success of a firm or supply chain by measuring the performance of specific vital operations. The objective in any supply chain is the client & transportation is a component of the supply chain. Recognizing that supply chain KPIs span a broad range of management issues and that each interruption has a significant impact on an organization's operations, this research prioritizes non-financial KPIs. Furthermore, we have realized that KPIs are equally as essential to companies as the phenomena of SCRes; nonetheless, KPIs are the primary cause of SCRes. It focuses on the link between supply chain resilience and KPIs and the advantages of using KPIs to establish or improve supply chain resilience (SCRes). It is especially true in every business where customers bind themselves into service level agreements and contracts, which will be evaluated through KPIs that both enterprise and its customer agreed upon. KPIs quantitative indicator is an essential aspect that firms must track and control to succeed (Nagyova & Pacaiova, 2009). KPIs capable of depicting the current state of a business and its distribution network should be defined for this purpose, assisting in the monitoring and evaluation of processes (Maestrini et al., 2017). Each firm creates and defines its KPIs based on functional context, responsibilities, and goals to collect relevant indicators for processes and needs. In SCM, the selection of correct KPIs is really important to integrate objectives at their different levels, which the result will be able to provide a broader view of the business.

KPIs must be contextualized to be project specific for project managers to use daily to improve project performance. This contextualization of the KPIs should make every important objective, component, and communication simple to see. The coordination, control, and observing of this complicated framework, just as its objectives, criticism connections, postponements, and data stream, need an agreement and displaying of how the parts of these frameworks cooperate (Dettmer, 1997). KPI is the key to substantially improving SC integration and overall performance. KPIs are a collection of metrics that focus on the parts of organizational performance that are most important for the organization's current and future success and which should be monitored twenty-four hours a day, seven days a week for some. A KPI cannot be a key to business if measured monthly, quarterly, or annually. In marketing or logistical words, the KPIs must be focused on the client. Client-oriented in corporate marketplaces has attracted academics and managers alike. It has become commonly used in service marketing. The term "customer-oriented businesses" refers to how well a firm understands and responds to its customer's needs in terms of continuous value development and execution. (Plomaritou & Konsta, 2013)

2.2 Relevant Theories

Theories are useful to cover the relevant research and support the research model. Therefore, this research used "Knowledge-Based Theory" for its support. The "Knowledge-Based Theory" is a firm theory that emphasizes resources and organizational capabilities as the primary sources of long-term competitive advantage and the foundation for strategy formation. Our approach starts with the problem as the fundamental unit of analysis, stating that the complexity of a problem determines the best solution search technique and the best way to organize that search. Our idea revolves around problem-solving and knowledge development. The manager's primary goal is to maintain above-average earnings by constantly discovering new information or solutions derived from unique combinations of current knowledge (Winter & Nelson, 1982; Nickerson & Zenger, 2004). According to our idea, managers select challenges while recognizing information sets or recent innovations, both inside and outside the association, that might be significant in finding answers to those issues (Winter & Nelson, 1982). The chosen issues represent an estimate of the projected value of prospective solutions and the company's capacity to accomplish high-esteem arrangements monetarily. This choice depends on an organization's information base and previous experience. Managers select challenges from a pool of unknown possible solutions. However, once a problem is selected, the work shifts to identifying relevant information and enhancing the likelihood of finding a high-value solution. This is accomplished by selecting organizational processes that manage search effectively. To structure the search most efficiently, organizationa must first comprehend the solution space for exploring. (Fleming

& Sorenson, 2001).

The need for effective organizational coordination and staff learning integration is emphasized in the plan (Kogut & Zander, 1992; Winter & Nelson, 1982). Theorists have failed to agree on a single definition of knowledge (Balconi et al., 2007). Some experts believe there is no difference between information and knowledge. Data is translated into information, which is transformed into knowledge, and wisdom. Gorman categorizes knowledge into four explanatory types (knowing what), procedural (knowing how), judgment (knowing when), and shrewdness (knowing why). Balconi and colleagues produced a typology list that included know-what, know-why, know-how, and know-who. The concept distinguishes between tacit knowledge (what an individual knows just in her or his self-mind) and explicit knowledge (what a person knows outside of his or her mind) (Winter & Nelson, 1982). Bicycling is a well-known example of tacit knowledge (Phelan & Lewin, 2000). Tacit knowledge is a useful resource for businesses since it is difficult to acquire and replicate, presuming that someone with the requisite information can be found. Since implied information cannot be recorded or archived (or classified), it must be learnt through noticing specialists and afterwards applying abilities (Grant, 1996; Kogut & Zander, 1992).

Regrettably, scholars have yet to define tacit knowledge (Ancori et al., 2000). Most academics believe that the only method to learn about someone's tacit knowledge is to observe them in action. Articulation is the process of making a person's implicit knowledge explicit to the rest of the world. The process of storing, preserving, standardizing, and transmitting articulated information inside an organization is known as coding. Some experts say tacit knowledge cannot be expressed (Grant & Fuller, 1995). When tacit information is articulated, it loses its status as knowledge and becomes merely data (Soo et al., 2002). Others, on the other hand, feel that all tacit knowledge may be transformed into explicit knowledge (Schulz & Jobe, 2001). Hakanson created a typology to define important words in the theory, such as explicit knowledge (know-why and know-what), internalized knowledge (explicit knowledge that is not used), procedural knowledge (understanding of skillsets), and tacit knowledge (awareness of sentiments) (articulate and inarticulate). The success or failure of an organization is determined by how it manages its knowledge holdings. Firms that outperform their competitors in finding, absorbing, and using new knowledge from internal and external domains, for example, will dominate them. It claimed that companies that can safeguard their explicit knowledge outperform those that cannot. Organizations can protect their data by assigning responsibilities to employees so that they do not see the "whole picture" of a procedure, using employment agreements and strict confidentiality to keep corporate secrets hidden, and imposing fines on departing personnel, such as deferred compensation (pension plans, stock options) (Liebeskind, 1996).

According to the idea, organisations are supposed to be varied, knowledge-bearing bodies that apply knowledge to the production of their essential commodities (Foss, 1996). Because they are stores of beneficial knowledge, businesses organize themselves in certain ways. By contributing to differential efficiency, knowledge stocks enable certain organizations to gain competitive advantages over others. Knowledge stocks also help to explain why certain businesses are more diverse and imaginative than others. This assumption contradicts earlier conceptions of the company, which see organizations as nothing more than a collection of contracts that determine the optimal distribution of property rights (Kogut & Zander, 1992). The idea also holds that knowledge is the most strategic of an organization's resources—it is generated, preserved, and utilized (Grant, 1996). Knowledge is a significant resource since it supports all human activity and all technology ultimately manifests information. According to the thesis, individuals, rather than organizations as a whole, produce, store, and use knowledge. Managers face a challenging challenge in coordinating and integrating the information of several employees. Individual specialized knowledge is integrated through four mechanisms, according to Grant (1996): (1) systems, plans, approaches, and practices; (2) sequencing (time-designed timetables); (3) schedules (complex hierarchical examples of conduct); and (4) bunch critical thinking and direction (Discussing, sharing, and learning are large parts of social correspondence). In addition, figure 1 shows the research model that provides a visual understanding of research variables.

Based on the relevant literature and theoretical background, the following hypotheses were

developed to address the research objectives and research questions:

H1: Supply Chain Integration has a significant impact on Supply Chain Visibility
H2: Analytic Integration has a significant impact on Supply Chain Visibility
H3: Developing KPIs has a significant impact on Supply Chain Visibility

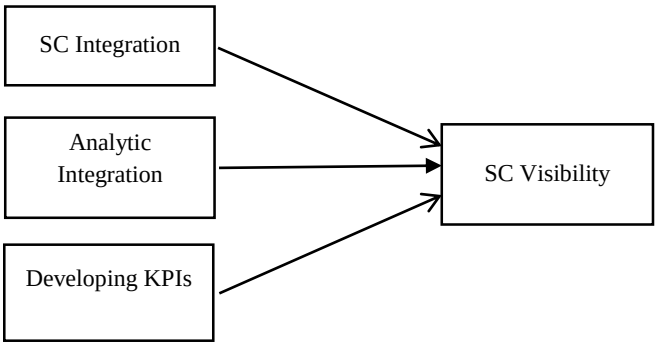


Figure 1: Conceptual Framework

3.0 Research Methodology

We have used explanatory research as a research approach in this study (Rashid & Amirah, 2017; Rashid et al., 2019; Rashid et al., 2021; Khan et al., 2021; Khan et al., 2022). The explanatory research helps to determine the cause of the occurrence of a specific phenomenon (Cohen et al., 2017; Hashmi & Tawfiq, 2020; Hashmi et al., 2020a; Khan et al., 2022; Rashid et al., 2020). This method usually describes a situation and problem in a casual relationship relative to the quantitative method. This method's prime objective is finding issues and key variables in a specific problem. The researcher characterizes paradigm as a fundamental arrangement of consistent convictions, a bunch of settlements on how issues ought to be deciphered, and in this manner, lead research (Creswell, 2003; Rashid et al., 2021). The difficulty is that the prescribed technique for characterizing research is to observe its paradigm (Hashmi et al., 2020b; Khan et al., 2022). This is fundamental because the decision of a particular worldview does not fit with the logical information of the researchers.

Further, the research strategy portrays strategy for information assortment and its explanation with an unmistakable arrangement of destinations. This method is a common course of action, for example, tending to the research queries (Hashmi et al., 2020; Smith et al., 2012; Hashmi et al., 2021; Khan et al., 2021). Yin (1994) stated that there are several essential research methods in humanistic social science, i.e., contextual investigations, history, recorded examination, overviews, and tests. Defined frameworks are based on the following conditions: 1. Center around contemporary occasions, 2. Command on conduct occasions, and 3—research queries. This study used a survey as a research strategy which is related to a deductive method, and it is normal in sociologies. The survey provides information from organized polls or meetings (Agha et al., 2021: Alrazehi et al., 2021; Das et al., 2021: Haque et al., 2021).

3.1 Sampling

A sample size might be depicted as more items or people that an analyzer wants to determine. Simultaneously, sampling is the technique of choosing a part of the population for an assessment to gauge an individual's perspectives, convictions, and qualities (Rashid & Rasheed, 2021). Sampling speeds up data collection and acquires exact outcomes. Regarding choosing the sampling technique, it relies upon the idea of the review or is possible to incorporate commonsense and hypothetical intimations.

In this study, we have used Convenience sampling as a non-probability sampling technique where the information is promptly accessible at the researcher's comfort. This technique assists researchers with getting reactions or completing meetings in a savvy way. It has a wide-running conversation on example size in scholarly writing. Picking the correct selected size is, at this point, pursued by researchers as the measurable strategies are all together and sensitive to test size and pick correctly. In this research, we have a sample size of 143.

3.2 Unit of Analysis and Measurement Scale

In this research, we have an organization as a unit of analysis. Likert-type are generally utilized in survey examination to evaluate perspectives and perceptions. Such evaluating scales incorporate more than five response classifications and get advantages and disadvantages of their own. Writing demonstrates that the Likert information is generously less dependable where the scale surpasses seven or drops 5 (Johns, 2010).

3.3 Statistical Tool

The statistical package for the Social Sciences (SPSS) is a statistical information-analytical method used by many academics. The system is a software package built primarily for media studies database handling and statistical research. In this study, the researchers used SPSS to analyze the subject data.

4.1 Research Analysis

4.1.1 Demographic Analysis

Table 1 presents the demographic attributes of the respondents; where most respondents are above 31-35 years and 25-30 years' age group, which are 42.7% (74 out of 200) and 16.8% (73 out of 143) and whereas the rest of the proportion of the age group is as follows below 25 years 5.6% (27 out of 143) and above 35 years 35% (25 out of 143). Regarding the educational environment, a simple majority had a university degree holding master's and bachelor's degrees, with 60.8% (77 out of 143) and 28.7% (46 out of 143), respectively. At the same time, the rest of the respondents held the degree of PhD 10.5%. In terms of designation majority of the respondents were supervisors and managers 35% (79 out of 143) and 52.4% (out of 143), and others were senior managers 7% (9 out of 143) and CEO.

Table 1: Demographic Profiles

		Frequency	Per cent	Valid Percent	Cumulative Percent
Age	below 25 years	8	5.6	5.6	5.6
	25 - 30 years	24	16.8	16.8	22.4
	31 - 35 years	61	42.7	42.7	65.0
	above 35 years	50	35.0	35.0	100.0
	Total	143	100.0	100.0	
Education	Bachelors	41	28.7	28.7	28.7
	Master	87	60.8	60.8	89.5
	PhD	15	10.5	10.5	100.0
	Total	143	100.0	100.0	
Designation	Supervisor	50	35.0	35.2	35.2
	Manager	75	52.4	52.8	88.0
	Senior manager	10	7.0	7.0	95.1
	Director	6	4.2	4.2	99.3
	CEO	1	.7	.7	100.0
	Total	142	99.3	100.0	
Total		143	100.0		

Source: SPSS Output

4.1.2 Hypothesis Testing

Exposure of data consistency has been completed by applying statistical tests of reliability. Sixteen questions were the questionnaire's items, which included both dependent and independent variables. The model summary in table 2 of multiple regressions explains that the value of adjusted R square 0.261 means 26.1 % of predictions can be made through the model used in this research paper. The ANOVA results in table 2 indicate F=15.558 and (0.000) means it is Significant. It shows predictor variables there will impact the SC visibility.

The coefficient results cover beta value, Co-linearity and significant value. The β value shows the relationship between the dependent and independent variables, either positive or negative. The β value of Analytical Integration is 0.009, which explains positive relationship exists between Analytical integration and Supply Chain Visibility. The β value of the Key performance indicator (KPIs) is 0.202 means positive relationships between KPIs and supply chain visibility. The β value of Forecast is 0.384 positive relationship between forecast and supply chain visibility. The significant value of all the variables is 0.000< 0.005 mean a significant influence of all the variables on supply chain visibility.

Table 2: Regression Analysis

		Model Summary		ANOVA		Coefficients		
	N	*R*	Adjusted R Square	*F*	Sig.	Std. Beta Coefficient	*t*	Sig.
		0.261	0.244	15.558	0.000			
SCI	143					0.384	4.281	0.000
AI	143					0.009	0.107	0.915
KPIs	143					0.202	2.332	0.021
SAVE	143						3.427	0.001

*Note: Predictors (SI, AI, DKPIs); *Standardized beta coefficient (Dependent Variable = Supply Chain Visibility); SCI=Supply chain integration; AI=Analytical Integration; DKPI=Developing KPIs; SCV=Supply chain visibility.*

5. Discussion

The researcher has made a hypothesis based on independent variables and taken (alpha = 0.05). Since the F-test is greater than the test critic value researcher accepts the significant difference among the population. In table 2, beta is the standardized coefficient obtained if we standardized the values. Moreover, in the significant column, SCI = 0.01 means the coefficient is significantly different from 0, AI = 0.915, which is greater than 0.05, means the coefficient is significantly not different from 0, KPIS = 0.021, which is < 0.05 means the coefficient is significantly different from 0 and Forecast = 0.00 < 0.05 which means the coefficient is significantly different from 0.

Companies face problems in supply chain integration, including low tech used in the integration process due to changes in data processing and data handling practices. The key to effective supply chain integration towards visibility is to connect systems and no of systems using different communication and data systems. KPIs must be maintained through optimization, and by measuring the impact, the organization must have an action plan to remove blackness in KPIs. They have standardized measuring KPIs, which helps to achieve organizational goals. KPI activities always require a degree of customization depending on the strategic business goals of the organizations. SC Visibility needs an analytic approach to run the data successfully. An amount of SC analytics is required to utilize logical techniques & applications to help decisions taking & at last, upgrade supply chain execution. Analytic tools are also applied to support KPIs because they include logical thinking and decision making to reduce task time and for effective outcomes. An organization could utilize existing innovations for upstream and downstream supply chain tasks and, gain straightforwardness & settle on taught decisions of their inward and outside supply chain rehearses.

5.1 Implications of Study

It will benefit different leading organizations in the shipping industry who are working very hard to provide 99% visibility to their customers to help grow their businesses. In this study, different factors on visibility might be identified so that companies could work on those particular factors to

improve their ongoing systems and gain overall success in different visibility sections. The goal of supply chain visibility is to have stronger insight into how supply chain works while also decreasing the risk. When combine such insights with user data, a supply chain can be adjusted to be as efficient as possible.

5.2 Limitation

According to research, the unavoidable limitation was the sample size is very small. It was difficult to find significant relationships from the data since statistical tests usually require a larger sample size to ensure a representative population distribution and to be considered representative of the groups of people to whom the results will be generalized or reported. The availability of self-reported data can limit a study. Researchers can only collect subjective measurements from physical participation because of restrictions at different offices. It is difficult to compare results between participants, as they may have used different criteria to evaluate them. The study using self-assessment data can be highly subjective and limited.

5.3 Recommendations

In the light of the limitations identified and findings of the study are the recommendation on which further control actions could be taken. Researchers can further find data and spread information to enhance knowledge in this. Control action could be taken on these: How to end and every process would be visible for the customers if end-to-end visibility is provided, then how will it be possible to manage huge data. The analytical approach can be trained but could not be changed completely. KPIs are the tools for improvement of performance; all shipping companies should acknowledge one common set of KPIs and implement them more systematically and methodologically. Benchmarking can implement in the shipping market and can benefit shipping companies. Performance management is facing significant transformation. Before, creating KPI dashboards was a huge undertaking, and KPIs were only available at aggregated levels, but now granular data from internal and external sources is available in real-time. This moves the performance management process from a monthly routine to an operational procedure focused on dealing with exceptions and continual improvement. Planners, for example, can be reminded of important supply chain interruptions, with small exceptions or potential solutions for bigger ones handled automatically. The performance management system can identify the root causes of an exception by either comparing it to a predefined set of underlying indicators or by conducting big data analyses, leveraging data mining and machine learning techniques. Based on the identified root cause, the system will automatically trigger countermeasures, such as activating a replenishment order or changing parameter settings in the planning systems, such as safety stocks.

5.4 Conclusion

In this study, the researcher tries to analyze the importance of visibility and the challenges usually faced by supply chain companies, especially logistic or 3pl industries. Visibility is a product to serve its customers with a platform where they can understand and extract data used in their daily process chain. However, companies are unsuccessful in attempting to give SC visibility. The research point is to arrange a pool of information regarding the factors that impacted the overall visibility. It provides a data hub on a single platform where customers can easily perform and use data according to their needs. Research is about to observe the relationship between dependent variables: SC integration, Analytical Integration, Forecast and KPI independent variable, i.e. SC visibility. In the search for greater comprehension of the issues, the researcher asked exploration questions to find the best outcome. The researcher gathered data from 126 respondents and performed multiple tests using SPSS. The objective of researcher found in the SPSS results summary that variability towards its model (*R2*) is 26.1%, where fewer predictions are to be observed.

Reference

Agha, A. A., Rashid, A., Rasheed, R., Khan, S., & Khan, U. (2021). Antecedents of Customer Loyalty at

Telecomm Sector. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 1352-1374.

Alrazehi, H. A. A. W., Amirah, N. A., Emam, A. S., & Hashmi, A. R. (2021). Proposed model for entrepreneurship, organizational culture and job satisfaction towards organizational performance in International Bank of Yemen. *International Journal of Management and Human Science, 5*(1), 1-9.

Ancori, B., Bureth, A., & Cohendet, P. (2000). The economics of knowledge: the debate about codification and tacit knowledge. *Industrial and corporate change, 9*(2), 255-287. https://doi.org/10.1093/icc/9.2.255

Ang, D., & Griffin, T. (2008). Supply chain management for higher education. *The Business Review, Cambridge, 11*(2), 28-33.

Balconi, M., Pozzali, A., & Viale, R. (2007). The "codification debate" revisited: a conceptual framework to analyze the role of tacit knowledge in economics. *Industrial and Corporate Change, 16*(5), 823-849. https://doi.org/10.1093/icc/dtm025

Caridi, M., Moretto, A., Perego, A., & Tumino, A. (2014). The benefits of supply chain visibility: A value assessment model. *International Journal of Production Economics, 151*, 1-19. https://doi.org/10.1016/j.ijpe.2013.12.025

Cohen, L., Manion, L., & Morrison, K. (2017). *Action research. In Research methods in education* (pp. 440-456). Routledge. https://doi.org/10.4324/9781315456539-22

Das, S., Ghani, M., Rashid, A., Rasheed, R., Manthar, S., & Ahmed, S. (2021). How customer satisfaction and loyalty can be affected by employee's perceived emotional competence: The mediating role of rapport. *International Journal of Management, 12*(3), 1268-1277. DOI: 10.34218/IJM.12.3.2021.119.

Dubey, R., Altay, N., Gunasekaran, A., Blome, C., Papadopoulos, T., & Childe, S. J., (2018). Supply Chain Agility, Adaptability and Alignment: Empirical Evidence from the Indian Auto Components Industry. *International Journal of Operations & Production Management, 38*(1), 129-148. https://doi.org/10.1108/IJOPM-04-2016-0173

Ellis, S., Morris, H. D., & Santagate, J. (2015). IoT-enabled analytic applications revolutionize supply chain planning and execution. *International Data Corporation* (IDC) White Paper, 13.

Fleming, L., & Sorenson, O. (2001). Technology as a complex adaptive system: evidence from patent data. *Research Policy, 30*(7), 1019-1039. https://doi.org/10.1016/S0048-7333(00)00135-9

Foss, N. J. (1996). Knowledge-based approaches to the theory of the firm: Some critical comments. *Organization Science, 7*(5), 470-476. https://doi.org/10.1287/orsc.7.5.470

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal, 17*(S2), 109-122. https://doi.org/10.1002/smj.4250171110

Grant, R. M., & Baden-Fuller, C. (1995, August). A knowledge-based theory of inter-firm collaboration. In *Academy of management proceedings* (Vol. 1995, No. 1, pp. 17-21). Briarcliff Manor, NY 10510: Academy of Management. https://doi.org/10.5465/ambpp.1995.17536229

Haque, I., Rashid, A., & Ahmed, S. Z. (2021). The Role of Automobile Sector in Global Business: Case of Pakistan. *Pakistan Journal of International Affairs. 4*(2), 363-383.https://doi.org/10.52337/pjia.v4i2.195

Hashmi, A. R., & Tawfiq, A. M. (2020). The effect of disruptive factors on inventory control as a mediator and organizational performance in Health Department of Punjab, Pakistan. *International Journal of Sustainable Development & World Policy, 9*(2), 122-134. https://doi.org/10.18488/journal.26.2020.92.122.134

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020a). Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan. *Management Science Letters, 11*(1), 77-86. https://doi.org/10.5267/j.msl.2020.8.028

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020b). Mediating effect of integrated systems on the relationship between supply chain management practices and public healthcare performance: Structural Equation Modeling. *International Journal of Management and Sustainability, 9*(3), 148-160. https://doi.org/10.18488/journal.11.2020.93.148.160

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2020). Exploring the dimensions using exploratory factor analysis of disruptive factors and inventory control. *The Economics and Finance Letters, 7*(2), 247-254. https://doi.org/10.18488/journal.29.2020.72.247.254

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021). Mediation of inventory control practices in proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management. 9*(1), 89-98. https://doi.org/10.5267/j.uscm.2020.11.006

Johns, R. P. (2010). Modes of Supply Strategy Making: An exploration of functional strategy process (Doctoral dissertation, University of Bath).

Kahn, K. B., & Mentzer, J. T. (1998). Marketing's integration with other departments. *Journal of Business Research, 42*(1), 53-62. https://doi.org/10.1016/S0148-2963(97)00068-4

Kearney, P. A., Wood, O., Hendrickx, E., McIntyre, G., Inoue, S., Goodwin, F., ... & Kaiser, W. (2014, April). Driving the industry towards a consensus on high numerical aperture (high-NA) extreme ultraviolet (EUV). In *Extreme Ultraviolet (EUV) Lithography V* (Vol. 9048, pp. 440-448). SPIE. https://doi.org/10.1117/12.2048397

Khan, S. K., Ahmed, S., & Rashid, A. (2021). Influence of social media on purchase intention and customer loyalty of generation Y with the mediating effect of conviction: a case of Pakistan. *Pakistan Journal of International Affairs.* 4(2), 526-548. https://doi.org/10.52337/pjia.v4i2.207

Khan, S., Benhamed, A., Rashid, A., Rasheed, R., & Huma, Z. (2022). Effect of leadership styles on employees' performance by considering psychological capital as mediator: evidence from airlines industry in emerging economy. *World Journal of Entrepreneurship, Management and Sustainable Development, 18*(7). https://wasdlibrary.org/publications/journals/wjemsd/

Khan, S., Rasheed., R., & Rashid, A., Abbas, Q., & Mahboob, F. (2022). The Effect of Demographic Characteristics on Job Performance: An Empirical Study from Pakistan. *Journal of Asian Finance, Economics and Business, 9*(2), 283-294. https://doi.org/10.13106/jafeb.2022.vol9.no2.0283

Khan, S., Rashid, A., Rasheed, R., & Amirah, N. A. (2022). Designing a knowledge-based system (KBS) to study consumer purchase intention: the impact of digital influencers in Pakistan. *Kybernetes, 51*(1). https://doi.org/10.1108/K-06-2021-0497

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science, 3*(3), 383-397. https://doi.org/10.1287/orsc.3.3.383

Lamming, R. C., Caldwell, N. D., Harrison, D. A., & Phillips, W. (2001). Transparency in supply relationships: concept and practice. *Journal of Supply Chain Management, 37*(3), 4-10. https://doi.org/10.1111/j.1745-493X.2001.tb00107.x

Lewin, P., & Phelan, S. E. (2000). An Austrian theory of the firm. *The Review of Austrian Economics, 13*(1), 59-79. https://doi.org/10.1023/A:1007854129748

Liebeskind, J. P., Oliver, A. L., Zucker, L., & Brewer, M. (1996). Social networks, learning, and flexibility: Sourcing scientific knowledge in new biotechnology firms. *Organization Science, 7*(4), 428-443. https://doi.org/10.1287/orsc.7.4.428

Maestrini, V., Luzzini, D., Maccarrone, P., & Caniato, F. (2017). Supply chain performance measurement systems: A systematic review and research agenda. *International Journal of Production Economics, 183*, 299-315. https://doi.org/10.1016/j.ijpe.2016.11.005

Mapes, J., New, C., & Szwejczewski, M. (1997). Performance trade-offs in manufacturing plants. *International Journal of Operations & Production Management, 17*(10), 1020-1033. https://doi.org/10.1108/01443579710177031

Mentzer, J. T. (2004). *Fundamentals of supply chain management: twelve drivers of competitive advantage*. Sage. https://doi.org/10.4135/9781452204604

Morran, L. T., Parmenter, M. D., & Phillips, P. C. (2009). Mutation load and rapid adaptation favour outcrossing over self-fertilization. *Nature, 462*(7271), 350-352. https://doi.org/10.1038/nature08496

Nagyova, A., & Pacaiova, H. (2009). How to build manual for key performance indicators--KPI. DAAAM *International Scientific Book*, 135-143. https://doi.org/10.2507/daaam.scibook.2009.15

Nickerson, J. A., & Zenger, T. R. (2004). A knowledge-based theory of the firm-The problem-solving perspective. *Organization Science, 15*(6), 617-632. https://doi.org/10.1287/orsc.1040.0093

Parker, J. & DeLay, D. (2008). The future of the healthcare supply chain. Healthcare financial management: *Journal of the Healthcare Financial Management Association. 62*. 66-9.

Patterson, K. A., Grimm, C. M., & Corsi, T. M. (2003). Adopting new technologies for supply chain management. *Transportation Research Part E: Logistics and Transportation Review, 39*(2), 95-121. https://doi.org/10.1016/S1366-5545(02)00041-8

Plomaritou & Konsta. (2013). Key Performance Indicators (KPIs) and Shipping Companies Performance Evaluation: The Case of Greek Tanker Shipping Companies. *International Journal of Business and Management, 7*(10), 3-4. https://doi.org/10.5539/ijbm.v7n10p142

Poulymenakou, A., & Tsironis, L. (2003). Quality and electronic commerce: A partnership for growth. *The TQM Magazine, 15*, 137-151. https://doi.org/10.1108/09544780310469244

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics, 135*(1), 514-522. https://doi.org/10.1016/j.ijpe.2011.09.001

Rashid, A. (2016). Impact of inventory management in downstream chains on customer satisfaction at manufacturing firms. *International Journal of Management, IT and Engineering, 6*(6), 1-19.

Rashid, A., & Amirah, N. A. (2017). Relationship between poor documentation and efficient inventory control at Provincial Ministry of Health, Lahore. *American Journal of Innovative Research and Applied Sciences, 5*(6), 420-423.

Rashid, A., Amirah, N. A., & Yusof, Y. (2019). Statistical approach in exploring factors of documentation process and hospital performance: a preliminary study. *American Journal of Innovative Research and Applied Sciences, 9*(4), 306-310.

Rashid, A., Amirah, N. A., Yusof, Y., & Tawfiq, A. M. (2020). Analysis of demographic factors on perceptions of inventory managers towards healthcare performance. *The Economics and Finance Letters, 7*(2), 289-294. https://doi.org/10.18488/journal.29.2020.72.289.294

Rashid, A., Rasheed, R., Amirah, N. A., Yusof, Y., Khan, S., & Agha, A. A. (2021). A Quantitative Perspective of Systematic Research: Easy and Step-by-Step Initial Guidelines. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 2874-2883.

Romano, P. (2003). Co-ordinationCoordination and integration mechanisms to manage logistics processes across supply networks. *Journal of Purchasing and Supply Management, 9*(3), 119-134. https://doi.org/10.1016/S1478-4092(03)00008-6

Schulz, M., & Jobe, L. A. (2001). Codification and tacitness as knowledge management strategies: an empirical exploration. *The Journal of High Technology Management Research, 12*(1), 139-165. https://doi.org/10.1016/S1047-8310(00)00043-2

Somapa, S., Cools, M., Dullaert, W. (2018). Characterizing supply chain visibility-a literature review. *International Journal of Logistics Management, 29*(1), 308-339. https://doi.org/10.1108/IJLM-06-2016-0150

Soo, C., Devinney, T., Midgley, D., & Deering, A. (2002). Knowledge management: philosophy, processes, and pitfalls. *California Management Review, 44*(4), 129-150. https://doi.org/10.2307/41166146

Swaminathan, J. M., & Tayur, S. R. (2003). Models for supply chains in e-business. *Management Science, 49*(10), 1387-1406. https://doi.org/10.1287/mnsc.49.10.1387.17309

Tung, Lai-Lai. (2004). Service Quality and Perceived Value's Impact on Satisfaction, Intention and Usage of Short Message Service (SMS). *Information Systems Frontiers, 6*, 353-368. https://doi.org/10.1023/B:ISFI.0000046377.32617.3d

Urciuoli, L., & Hintsa, J. (2018). Improving supply chain risk management-can additional data help? International *Journal of Logistics Systems and Management, 30*(2), 195-224. https://doi.org/10.1504/IJLSM.2018.091962

Winter, S. G., & Nelson, R. R. (1982). An evolutionary theory of economic change. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.

Wycislak, (2021). Real Time Visibility in a Transportation Network of a Complex Supply Chain. *International Journal of Supply Chain Management. 10*(3), 45-51.

Yin, R. K. (1994). Discovering the future of the case study. Method in evaluation research. *Evaluation Practice, 15*(3), 283-290. https://doi.org/10.1016/0886-1633(94)90023-X

South Asian Journal of Social Review
2022 Vol. 1, No. 1, pp. 21-41
DOI: 10.57044/SAJSR.2022.1.1.2205

Industrial Revolution 4.0 and Supply Chain Digitization

Syed Baber Ali [1*]

[*1] *Researcher, Department of Business Administration, Iqra University, Karachi, Pakistan*

**Corresponding Author Email: syed.41075@iqra.edu.pk*

Article History

Received: 20 June 2022
Revised: 27 June 2022
Accepted: 29 June 2022
Published: 30 June 2022

JEL Classification
N70
O14
C44
O30
R41

ABSTRACT

The latest technological advancements have forced logistics and supply chain digitization in general. Organizations that embrace and prepare for change can survive and maintain a competitive position in the new global business environment. In contrast, the industrial businesses that do not implement the new rules will not survive long and will eventually be obsolete. Therefore, the concept of digitization and industrial revolution 4.0 in supply chain management was intended to be reviewed to determine its trending dimensions. This paper conducted a systematic review of 60 articles on the research topic by considering the publication during the period 2017 to 2021. The paper investigated the evolutionary changes in the supply chain's operational functions in the digital and industrial revolution 4.0 context. The main objective of reviewing articles was to identify the new trend on the search topic. Some trends identified in the current research include the use of blockchain in the supply chain and the nine elements of industry 4.0, the internet of things. The paper is equally significant for researchers and practitioners as it explains industry 4.0 and supply chain digitization trends. Future research can evaluate the mathematical, decision-making, and simulation techniques to support the research domain by increasing its applicability. This research allows us to consider the validation of the digital supply chain models and their components presented preliminary by experts that provide a headway toward emerging and new constructs in this domain.

Keywords: *Supply chain digitization, Industry 4.0, Big data, Blockchain, IoT, Operations*

Citation of this article:

Ali, S. B. (2022). Industrial Revolution 4.0 and Supply Chain Digitization. *South Asian Journal of Social Review, 1*(1), 21-41. https://doi.org/10.57044/SAJSR.2022.1.1.2205

Industrial Revolution 4.0 and Supply Chain Digitization

1. Introduction

Supply Chain is a network created between suppliers and organizations to produce and distribute products. It shows steps essential for ensuring the safe and sound delivery of services and products to the ultimate customers. The practical and efficient management of the Supply Chain is crucial because it enables organizations to reduce costs, save time and increase outputs (Hugos, 2018). However, in traditional supply chain practices, specific essential attributes are missing that are needed for the betterment of future businesses. One of the drawbacks of the traditional supply chain was the existence of isolated mechanisms and processes that lack integration. In response to this, there is a need to shift from the traditional supply chain to the Digital Supply Chain, which is, in other words, a transformation of systems from the former into highly interconnected and integrated work systems. The digital supply chain systems do not imply based on the tangibility and intangibility of products and services but rather deal with how the supply chain operations can be better managed (Agrawal & Narain, 2018). Industry 4.0 terminology was thought up for marking the fourth industrial revolution. This new concept was introduced when the Internet of Things (IoT) was enabled in the manufacturing and production environment. Industry 4.0 envisions an intelligent workstation where the machines' global networks exchange and control the information autonomously. Industry 4.0 creates an environment where physical-cyber systems allow organizations to operate independently. For instance, by enabling industry 4.0, the manufacturing process will be known to machines that require applying to all the manufacturing plants' products. Also, it enables variations needed to make to the products. This makes products distinctively identifiable, whose route and configuration are unique in the production line. Since the collaboration among manufacturers, customers and suppliers are significant in increasing the transparency at all levels from the origin to the final destination point, it is, therefore, essential to study the effect of Industry 4.0 on the overall supply chain (Manavalan & Jayakrishna, 2019).

There are many definitions of a Digital Supply Chain. Some authors have defined it as an intelligent supply chain that allows organizations to take advantage of technologically advanced operations that help integrate various actors in the Supply Chain (Garay-Rondero et al., 2020). Also, such a supply chain synchronizes various processes, including transportation systems and warehouses, to enjoy web-enabled systems. These types of supply chain networks have the potential to provide effective communication and cooperation between the software and hardware. The main objective of such a supply chain is to synchronize communication and integration among organizations (Shukor et al., 2020). The main objective of the current research was to identify the new trends on the search topic. Section 2 below presents a literature review of the most recent research on supply chain digitization and industry revolution 4.0. Section 3 articulates how the entire research work is carried out and the methods, approaches, and techniques used to analyze the literature reviewed. Data visualization and analysis are presented in section 4 of the paper. The research findings and discussion are presented in the below sections with a detailed explanation of each parameter used for the systematic analysis of all literature reviewed. In the current global and technologically advanced era, organizations from various industries show great interest in investing in the digitization of their business activities and operations. Some great examples of the organizations that took initiatives in digitizing their operations are logistics operators, including UPS, FedEx, and DHL. In addition, some e-commerce organizations' examples are Alibaba and Amazon. These organizations invested heavily in digitizing their supply chain operations (Reardon et al., 2021).

Digitization converts physical information into a digital flow by redesigning practices, procedures, and processes to fit the functionality of digital and technological systems (Gremyr & Halldorsson, 2021). Digitalization plays a significant role in the logistics and supply chain industry. The digital supply chain is being used widely for informing the latest requirements for digital standards and infrastructures and the potential to connect device-aware Apps with their supply chains of products and services (Hennelly et al., 2019). Further, digitized logistics service providers play a significant role

in cyber supply chain risk management (CSCRM) processes towards becoming more supply chain-oriented and countering events having higher cyber threats that highlight its importance (Creazza et al., 2021). For this reason, Table 1 expresses a comprehensive definition of digital technologies defined by various researchers to better understand the concept of Industry 4.0.

Table 1: Digital technologies and their definitions

S. No	Digital Technology Definitions	Author
1	The Internet of Things (IoT) is a network of interrelated computing devices connecting humans, machines, and other devices using the ability to gather and exchange data. Over such a network, data is transmitted without human-to-computer or human-to-human interactions.	(Al-Hinai & Singh, 2017)
2	Significant data analytics analysis varied large datasets to determine the concealed meaning and patterns and find relations among them for planning decisions. Such an analysis helps improve efficiency, create business value, and lead to more accurate, faster, and better decision-making. Big data analytics enable industries to access and examine real-time information to forecast production requirements and adopt prescriptive, predictive, and proactive maintenance.	(Ren et al., 2019)
3	Augmented reality (AR) enables industrialists to bring digital factors to life via smartphone video cameras that are famous among leisure-activity users and gamers. In the manufacturing industry, AR wearables offer the operators real-time information and help them make better decisions.	(Monteiro, 2017)
4	Integrated systems help create connections among all industry 4.0 elements and other networks that were working in silos. System integration helps companies increase agility and create transparency in the supply chain processes.	(Weltzien, 2016)
5	Autonomous robots now perform several tasks that are considered dangerous for humans. The robots that also communicate with people are termed robotics.	(Hentout et al., 2019)
6	Cloud computing is the availability of computing power, data storage, software, hardware, and other resources on-demand. For this purpose, several internet-based forums are available that help in increasing business transactions by creating voluminous data from various external and internal sources.	(Mohsen and Woods, 2019)
7	Industry 4.0 enables companies to benefit from 3D simulations during product development. Simulation optimization enables companies to mirror the physical world into the virtual world by incorporating real-time data.	(Vaidya et al., 2018)
8	Additive manufacturing is also known as 3D printing. It is an approach used in production for creating more robust systems and lighter parts. Using such technology provides several benefits to users, including reduced numbers of parts required for assembly, production steps, and material waste.	(Conner et al., 2014)
9	Safeguarding systems from cybercrimes and cyberattacks and securing information is crucial in the diverse fields with network-based connectivity and communication protocols. Some common threats related to cybersecurity include insider threats, crypto-jacking, and IoT-related risks.	(Zhao et al., 2020)
10	Blockchain enables the creation of a system that records information difficult or impossible to cheat, hack or change. It is a digital ledger that records transactions, duplicate them, and distribute that across the network on the blockchain.	(Koeppl and Jeremy, 2017)

Source: Literature Review

2. Previous Literature

According to Ali et al. (2021), a case of readymade garments from Bangladesh identifies bid data analytics as a significant influencing factor, and digital technology enhances the supply chain resilience. Creazza et al. (2021) stated that human resource is also significant in improving supply chain-based cyber resilience. Research conducted by Dennehy et al. (2021) demonstrated that the mindfulness of organizations is essential for enabling resilient supply chains. Therefore, the authors use organization mindfulness and extensive data analytics capabilities for advancing knowledge and developing supply chain resilience. Pursuing supply chain resilience by optimizing personnel capacity, logistics infrastructure, data management, and digitalization is recommended for outbreaks or pandemic situations such as COVID-19 (Herold et al., 2021). The only certainty in the current supply chain disruptions is uncertainty, which requires new technology-based solutions. The COVID-19 pandemic situation around the globe reinforced the need for understanding how technologies including blockchain, additive manufacturing, and artificial intelligence help organizations in effectively dealing with emergencies (Wamba et al., 2021).

However, blockchain increases visibility in the supply chain by increasing transparency (Rogerson & Parry, 2020). Rogerson and Parry (2020) summarized their research findings by articulating that technological applications are required for purchasing food products and transferring funds. In this regard, there are a few challenges in the food industry to implementing blockchain technology for digitizing the supply chain. These challenges are consumers' willingness to pay, consumer data access, governance, fraud, and human error at the boundaries and trust of the technology. Therefore, the use of blockchain in the supply chain is increasingly trending in this technologically advanced era. The Internet of Things and other digitized technologies increase the transparency in maintaining the inventory to avoid any shortage or stockpiling (Friday et al., 2021). Furthermore, Gohil and Thakker (2021) argued that the challenge that the global supply chain is facing is the need to use the internet of things. Digitization of process enables organizations to increase their potential to better collect and analyze their big data and improve connectivity and information visibility along with reliable and fast physical networks and delivery options that significantly impact supply chain networks and logistics productivity (Herold et al., 2021). Similarly, Koh et al. (2019) identified big data analytics as the most frequently used technology in industry 4.0. Correspondingly, Koh et al. (2019) and Haddud and Khare (2020) stated that big data analytics is trending, which requires the inculcation of procedures for moving toward supply chain digitization. In contrast to the above discussion, Table 2 presents a summarized literature review on supply chain digitization and industry 4.0.

Table 2: A summarized literature on supply chain digitization and industry 4.0

Citations	Article title	Articles Viewed	Citations	Study focus	Findings
Acioli et al. (2021)	Applying Industry 4.0 technologies in the COVID–19 sustainable chains	150	23	To investigate the impact of technological innovations in industry 4.0 and determine gaps, key challenges, and opportunities that emphasize using new trends in the supply chain digitization.	The findings highlight a challenge related to social inequalities regarding the human workforce position when machines in the labour market replace these. The man-machine relationship as a gap is identified in the research. The authors suggested that society 5.0 or a super-smart society concept provides quality of life by finding resolutions to social challenges.
Bai et al. (2021)	Guest editorial	195	21	To study the technological advancements trend in the recent past.	The technological advancements in the recent past incorporated a massive variety of industry 4.0 and information technologies that take benefit of quantum computing, cyber-physical systems, Internet of Things, mobile technology, predictive analytics, artificial intelligence (AI), and integrate blockchain technology.
Barbieri et al. (2021)	Guest editorial Emerging research and future pathways in digital supply chain governance	128	1	The authors carried out research to identify future pathways in the governance of the digital supply chain.	According to the authors, there is a need to consider a broader range of supply chain issues and parts in understanding digital technology's impact on supply chain governance. Also, they mentioned in their research findings that there is a need for future studies in collaboration with the cybersecurity domain to develop a detailed understanding of cybersecurity in digital supply chain technologies.
Culot et al. (2021)	The ISO/IEC 27001 information security management standard: literature review and theory-based research agenda	96	10	A study was conducted to explore the contemporary technological trend in various industries.	Authors articulated that a change is required due to emerging technology-based opportunities and an interconnected world. Since data is considered the new oil, organizations these days are required to secure their information assets.
Frederico (2021)	Towards a Supply Chain 4.0 on the post-COVID-19 pandemic: a conceptual and strategic discussion for more resilient supply chains	54	15	The author studied the impact of disruptive technologies on supply chain resilience.	Disruptive technologies play a significant role in promptly responding to emergency events such as the COVID-19 pandemic. In this regard, the authors suggested that using supply chain 4.0 as a transformational strategic development is highly effective, most notably for the post-pandemic period.
Friday et al. (2021)	A collaborative approach to maintaining optimal inventory and mitigating stockout risks during a pandemic: capabilities for enabling healthcare supply chain resilience	752	7	A research study was carried out to study the capabilities required to enable the supply chain resilience in health care sectors to mitigate risks associated with risks of inventory stockouts and maintain optimal levels of inventory in the COVID-9 pandemic situation.	The research findings proposed a need to reinforce capabilities via supply chain digitization that will improve mechanisms for determining the optimal levels of medical inventory in the pandemic. In addition, it is articulated in the research that the emerging technologies, including the Internet of Things and other digitalization technologies, increase the transparency in maintaining the medical inventory to trigger any panic and better manage the inventory needs by stockpiling.
Garay-Rondero et al. (2020)	Digital supply chain model in Industry 4.0	213	87	A study was conducted to design a conceptual model containing a few significant components in shaping	The authors proposed five crucial components to implement Industry 4.0 technology into Digital Supply Chain Management successfully. The components include the need to manage projects

				Digital Supply Chains (DSCs) by the acceleration and implementation of industry 4.0.	by managing and digitalizing organizations' behavior and culture, technology and human relationship in Digital Supply Chain Management, the information physical Supply Chain Network Systems and technology infrastructure, and the deployment of features and enablers of industry 4.0 technology, and maintaining physical and digital Supply Chain Flow (SCFs) for providing the good digitization.
Garza-Reyes et al. (2019)	From linear to circular manufacturing business models	40	14	To design a business sustainability model or design based on reusing electronic appliances.	The study outcomes presented a model for reusing scrap electronic appliances that include additive manufacturing, reverse logistics and integration of web-based technologies. The study suggested improving business sustainability by reinserting waste in the manufacturing of products.
Gohil and Thakker (2021)	Blockchain-integrated technologies for solving supply chain challenges	55	1	To study the challenges that the global supply chain is facing.	The authors presented some challenges the global supply chain faces and suggested a need to use blockchain technology, the internet of things and artificial intelligence as a solution.
Bai et al. (2021)	Guest editorial	195	1	A study analyses the trend of the state-of-the-art technology used in the industries effectively in an emergency.	The study's finding suggests that the Internet of Things is one of the technologies used effectively during any pandemic situation.
Hennelly et al. (2019)	Reconfiguring business processes in the new political and technological landscape	5	2	To determine how to make managers able to become influential decision-makers.	The study's findings show that the research directly affects educational institutions that produce future managers who successfully work in a data-driven business world.
Hofmann et al. (2020)	Research in business service purchasing: current status and directions for the future	118	2	The authors conducted a study to determine the field's upcoming developments and practical implications.	The outcomes presented recent service purchasing trends that include near-shoring and Globalization; corporate social responsibility and sustainability; external and internal collaboration; hybrid servitization and products; value-driven payment and contract systems; artificial intelligence; big data analytics; and atomization of processes.
Ivanov et al. (2021)	Supply chain resilience and its interplay with digital technologies: making innovations work in emergencies	52	10	A study to find the effect of the supply chain's resilience on small enterprises.	The research suggests that the digitalization of the supply chain is highly characterized by the adoption of digital supply chain tools and the level of digital maturity. Both these levels of adoption and maturity of digital tools have a significant effect on the supply chain's resilience that is more focused on small enterprises.
Jonsson et al. (2021)	Guest editorial: The future of SandOP: dynamic complexity ecosystems and resilience	64	1	A study was conducted to discuss the future of AandOP, dynamic complexity, resilience, and ecosystems.	The authors concluded in their study that the future of Sales and operations planning is highly based on building resilient supply chains by adopting ecosystems and moving towards digitization technologies.
Koh et al. (2019)	The fourth industrial revolution (Industry 4.0): technologies disruption on operations and supply chain management	10	103	To identify principles of industry 4.0.	The authors mentioned five technologies that are frequently used in industry 4.0. The technologies include Big Data Analytics, the Internet of Things (IoT), 3D printing, and Cloud and Robotics Systems.

Ortt et al. (2020)	Implementing Industry 4.0: assessing the current state	11	14	This study focused on the investments made for the implementation of industry 4.0.	Many developed countries, including Europe, the USA and China, are investing in implementing industry 4.0 using different names such as smart industry, smart manufacturing, and intelligent production. These countries are following digitization trends and using information and communication technology to optimize business processes in their countries. However, large and small organizations differ significantly in their process for applying and implementing industry 4.0.
Wamba et al., (2021)	Guest editorial Emerging technologies in emergencies	61	2	To study the impact of industry 4.0 and other effective technologies on company operations in the emergencies such as the COVID-19 pandemic.	Understanding how blockchain, additive manufacturing and artificial intelligence help organizations effectively deal with emergencies.
Delesposte et al. (2021)	Use of multicriteria decision aid methods in the context of sustainable innovations: bibliometric, applications and trends	85	1	Current theoretical approaches and discussions by applying MCDA bibliometric methods for sustainable innovations.	The findings present MIS trends based on the most explored areas, including social or environmental impact, production and distribution, and product development assessment.
Prause et al. (2021)	Digitalization and the third food regime	53	30	To explore how digital technologies' application impacts the food and agriculture system regarding the third food regime.	The result of the study shows that multinational food and agriculture organizations take over the business models of digital technology-driven companies.
Vrana and Singh (2021)	Cyber-Physical Loops as Drivers of Value Creation in NDE 4.0	21	6	To provide an overview of numerous use cases, cyber-physical loops for value creation, key-value streams, and the NDE ecosystem for stakeholders in the system.	Industry 4.0 and NDE (NDE 4.0) provide opportunities for Industries to gain customer groups and adjust value perception accurately. Integrating the cyber-physical loop and NDE enhance the chance for the industry to shift towards a value centre from a cost centre.
Zhang et al. (2021)	Industry 4.0 and its Implementation: a Review	148	3	The research aims to review articles to study Industry 4.0 scope, objectives and implementations, along with the barriers and hurdles in the implementation.	The finding of the research suggests some solutions to overcome the potential challenges and barriers.
Wamba and Queiroz (2021)	Responsible Artificial Intelligence as a Secret Ingredient for Digital Health: Bibliometric Analysis, Insights, and Research Directions	60	6	A study was conducted to explore the dynamics of the interplay between AI and digital health approaches, considering the responsible AI and ethical aspects of scientific production over the years.	The authors, in this regard, articulated that public blockchain can effectively support the areas of the supply chain that lacks institutional interests. In addition, Blockchain help organizations in effectively dealing with emergencies such as COVID-19.
Çalık (2021)	A novel Pythagorean fuzzy AHP and fuzzy TOPSIS methodology for green supplier selection in the Industry 4.0 era	58	52	The study aims to design decision-making approaches based on the elements of Industry 4.0 for effectively selecting green suppliers	An approach is proposed that includes the judgment of various industry experts and is presented by terms that are based on Pythagorean numbers.

				by integrating TOPSIS and AHP methods.	
Shemov et al. (2020)	Blockchain applied to the construction supply chain: A case study with a threat model	59	19	The study aimed to determine CSC's challenges in terms of efficiency and productivity.	The results articulate that blockchain is an ultimate solution to various challenges that CSC faces regardless of the robustness and security of the data protection risks and information flow.
Zhang et al. (2020)	Application of blockchain in the field of intelligent manufacturing: Theoretical basis, realistic plights, and development suggestions	49	5	To study the blockchain application in the intelligent manufacturing field.	The research outcomes proposed a theoretical basis for blockchain application in intelligent manufacturing. Also, some realistic plights are pointed out that suggest promoting blockchain applications in the intelligent manufacturing field.
Radanliev et al. (2020)	Artificial intelligence and machine learning in dynamic cyber risk analytics at the edge	63	24	Via literature review, the authors aimed to determine creative methodologies regarding cyber analytics and to identify potential risks that cause disrupting behaviors towards socio-technical systems.	The study's outcomes present a model for interdependencies and connections among system components to internal and external systems and services.
Radanliev et al. (2020)	Cyber risk at the edge: current and future trends on cyber risk analytics and artificial intelligence in the industrial internet of things and industry 4.0 supply chains	173	36	To determine a self-adapting and dynamic supply chain system based on real-time intelligence, machine learning and Artificial Intelligence for cyber risk analysis.	The research findings show that adopting Internet of Things technology depends on cyber recourses. Moreover, the latest new designs enable Small and Medium Enterprises to visualize the resources required for the integration process.
Zhao, Ji, and Feng (2020)	Smarter supply chain: a literature review and practices	68	15	A study was conducted to analyze the literature on a smarter supply chain.	The research findings presented the industrial applications and academic work in Sustainability Supply Chain. However, many significant problems were not examined adequately, including technology-driven supply chain, full data potential realization, multi-dimensional SSCRM, hazard warnings, and data security monitoring that leaves room for future research.
Golan et al. (2020)	Trends and applications of resilience analytics in supply chain modeling: systematic literature review in the context of the COVID-19 pandemic	141	179	To study supply chain resilience research that considers resilience quantification and modeling, and integrates the supply chain with other networks, including command and control and transportation.	The authors presented a comprehensive approach for supply chain resilience network quantification of physical and social networks required to address the critical issues in the field.

Notes: Citations are recorded till November 2021.

3. Methodology

This section describes the process used to search the literature to select relevant articles for the review. In this regard, the main objective was to map and evaluate the available literature to identify futuristic new fields and trends in the study subject. Figure 1 represents the methodology that was used to analyze the study objectives. The study selected articles from two databases (Springer and Emerald). Because these two sources provide a great collection of well-reputed management journals that are peer-reviewed, it is a multidisciplinary database as it covers various subjects, including Marketing and Strategy, Management Science and Operations, Organizational Behavior and Human Resources, Economics, and Accounting and Finance (NCI Library, 2021).

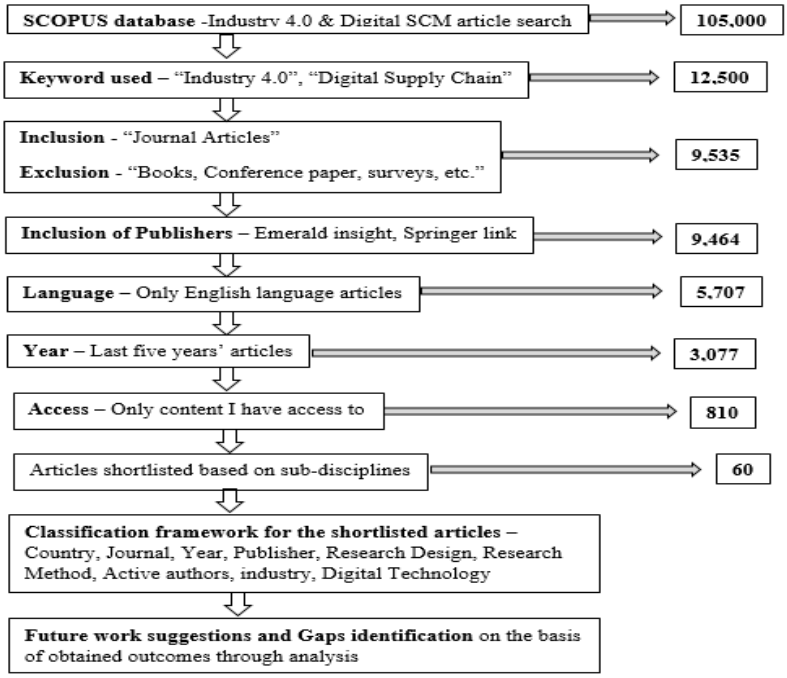


Figure 1: Research methodology used in the study

3.1 Framework for Analysis

This study followed a systematic framework starting with the 1) country contribution, 2) journal, publication year, 3) publisher, 4) adopted research design, 5) adopted research method, 6) active authors, 7) industry, and 8) digital technology. Further, the analysis was developed in chronological order, domains of applications, types of research, and the application of industry 4.0.

3.2 Methodology Implementation

For mapping the existing literature, it was imperative to set the key terminologies to access relevant literature for synthesizing the literature reviews. Therefore, the keywords "Industry 4.0" and "Digital Supply Chain" were considered to extract published articles from 2017 to November 2021. After performing a search cycle, it was found that a total of 26 articles were found relevant to the study topic in the English language from Emerald and 34 articles from Springer. In this regard, Table 3 lists the total number of year-wise publication distribution.

Table 3: Total number of publications

Year	Springer Publications	Emerald Publications	Total Publications
2017	0	0	0
2018	1	0	1
2019	2	4	6
2020	9	5	14
2021	22	17	39
Total	34	26	60

Table 3 shows that the publications on supply chain digitization and industry 4.0 increased exponentially from 2019 to 2021. The graph trend confirms the utilization of industry revolution 4.0 and digitization in supply chain management.

3.2.1 Classification based on publication year

Figure 2 below shows the year-wise classification of published articles from 2017 to November 2021. In 2017 and 2018, the research trend of industry 4.0 technologies and supply chain digitization was insignificant. Only one relevant article was published in 2018, while there was no relevant publication in 2017. However, the publication drastically increased in 2019, and three industries, including manufacturing, army, and aviation, concentrated on digitization and industry 4.0. However, the topic expanded to other industries, including automotive, healthcare, and logistics manufacturing operations, from 2019 to 2021.

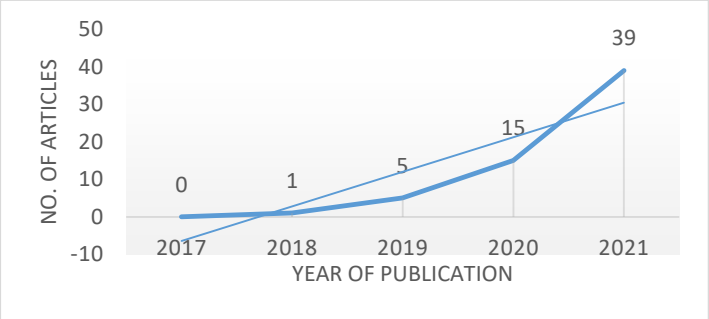


Figure 2: Classification based on publication year

3.2.2 Classification based on journals and publisher

The International Journal of Operations and Production Management published a large number of articles in the selected research domain, which is around 8.3%. However, other significant journals that published most of the articles include Frontiers of Engineering Management, Global journal of flexible systems management, Journal of Manufacturing Technology Management, Modern Supply Chain Research, and Applications, which contributed 5% (each) to this study. The details of articles and their respective publishers, along with their h-index, are presented in Table 4.

Table 4: Articles' classification based on journal

Journal	h-index	Publisher	No. of Articles	%
International Journal of Operations and Production Management	138	Emerald	5	8.3
Frontiers of Engineering Management	11	Springer	3	5.0
Global journal of flexible systems management	31	Springer	3	5.0
Journal of Manufacturing Technology Management	70	Emerald	3	5.0
Modern Supply Chain Research and Applications	4	Emerald	3	5.0
Annals of Operations Research	105	Springer	2	3.3
Environment Systems and Decisions	43	Springer	2	3.3
Information Systems Frontiers	66	Springer	2	3.3
International Journal of Physical Distribution and Logistics Management	111	Emerald	2	3.3
Journal of Nondestructive Evaluation	43	Springer	2	3.3
Management Review Quarterly	17	Emerald	2	3.3
SN Applied Sciences	52	Springer	2	3.3
Supply Chain Management: An International Journal	115	Emerald	1	6.7
Agriculture and Human Values	76	Springer	1	1.7
AI and Ethics	29	Springer	1	1.7
AI Perspectives	154	Springer	1	1.7
Asian Journal of Business Ethics	187	Springer	1	1.7
Business Process Management Journal	81	Emerald	1	1.7
Chinese Journal of Mechanical Engineering	33	Springer	1	1.7
Journal of Cybersecurity	16	Springer	1	1.7
Health and Technology	18	Springer	1	1.7
Industrial Management and Data Systems	103	Emerald	1	1.7
International Journal of Lean Six Sigma	38	Emerald	1	1.7
International Journal of Metal casting	19	Springer	1	1.7
International Journal of Productivity and Performance Management	61	Emerald	1	1.7
Journal of Data, Information and Management	162	Springer	1	1.7
Journal of Enterprise Information Management	61	Emerald	1	1.7
Journal of Fashion Marketing and Management	52	Emerald	1	1.7
Journal of Humanitarian Logistics and Supply Chain Management	25	Emerald	1	1.7
Journal of the Knowledge Economy	27	Springer	1	1.7
Neural Computing and Applications	80	Springer	1	1.7
Operations Management Research	28	Springer	1	1.7
OPSEARCH	20	Springer	1	1.7
Production Engineering	33	Springer	1	1.7
Rajagiri Management Journal	1	Emerald	1	1.7
Russian Engineering Research	19	Springer	1	1.7
Soft Comput	81	Springer	1	1.7
The TQM Journal	67	Emerald	1	1.7
Total			60	100

In continuation of Table 4, Figure 3 represents the proportion of published articles in Springer and Emerald, where Springer contributed most with a percentage of 57%, whereas Emerald contributed 43%. These articles were extracted from the domain of supply chain digitization and industry 4.0 and published in various journals of Springer and Emerald.

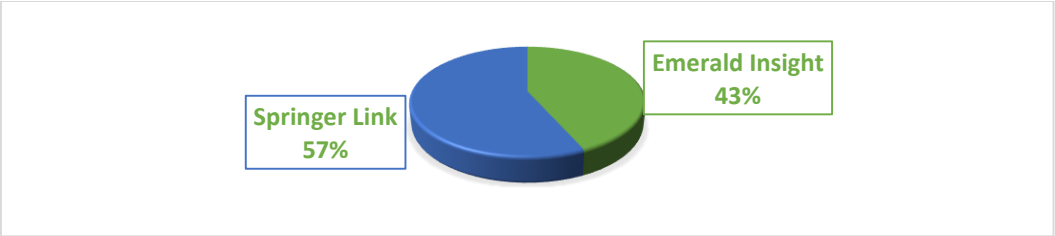


Figure 3: Proportion of published articles

3.2.3 Classification based on publication country

The articles considered in the current research included publications published in 23 countries worldwide. Table 5 below shows a detailed description of articles' classification based on the publication country. Among the 60 shortlisted articles, Germany and U.K. contributed the most, with 23.4% of the total published articles. The U.S.A. followed them with 10% of the research. However,

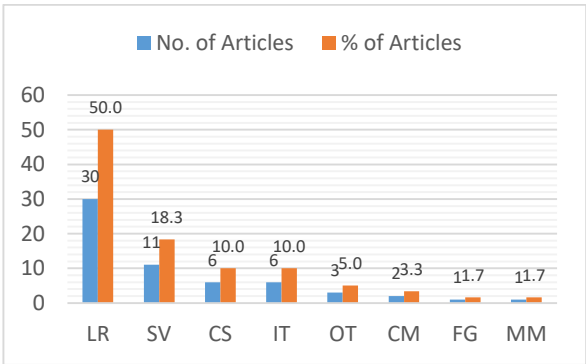
several countries contributed a very low 1.7% each. The countries include Africa, France, Hong Kong, Japan, Mexico, Netherland, Russia, South Africa, Spain, Switzerland, and the UAE. Each of these countries only published one article in the five years time span.

Table 5: Articles' classification based on publication country

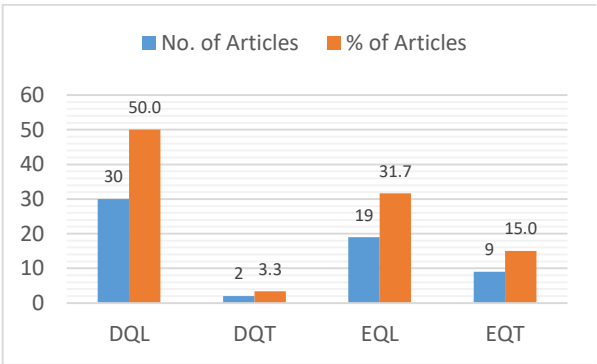
S. No.	Name	No. of Articles	%
1	Germany	7	11.7
2	U.K.	7	11.7
3	U.S.A.	6	10.0
4	Brazil	5	8.3
5	China	5	8.3
6	India	5	8.3
7	Italy	4	6.7
8	Sweden	3	5.0
9	Australia	2	3.3
10	Bangladesh	2	3.3
11	Turkey	2	3.3
12	Africa	1	1.7
13	Austria	1	1.7
14	France	1	1.7
15	Hong Kong	1	1.7
16	Japan	1	1.7
17	Mexico	1	1.7
18	Netherlands	1	1.7
19	Russia	1	1.7
20	South Africa	1	1.7
21	Spain	1	1.7
22	Switzerland	1	1.7
23	UAE	1	1.7
	Total	60	100.0

3.2.4 Classification based on research method and research design

The used research methods in published articles were rigorously analyzed. The most used methods were literature review, survey, and case study. Figure 4 presents the details regarding the research methods adopted by published articles. From the bar graph in Figure 4, it is clear that the literature review method is mainly considered by authors followed by the survey method. Around 50% of the articles adopted the literature review research method, 18.3% of the articles used survey methods, 10% adopted the case study method, and 10% of articles considered the interview method. However, the remaining 11% adopted conceptual models, mathematical models, and some other research models.



Note: LR: Literature Review, SV: Survey, IT: Interview, FG: Focus Group, MM: Mathematical Model, CS: Case Study, OT: Others



Note: LR: DQL: Desk Qualitative, DQT: Desk Quantitative, EQL: Empirical Qualitative, EQT: Empirical Quantitative

Figure 4: Classification according to research method and research design

Desk and empirical research are considered in the current research to classify the research designs of all 60 articles. The details regarding the research designs of articles are presented in Figure

4, where it is clear that authors mainly use the desk qualitative research design in their articles. Following desk qualitative, empirical qualitative is the second most used research design in the articles. Around 50% of the articles used a desk qualitative research design, 31.7% used an empirical qualitative design, 15% used an empirical quantitative design, and only 3.3% used a desk quantitative research design. Besides these four research designs, none of the articles used a practical triangulation design. According to Flick (2018), empirical triangulation enables researchers to include several decision-making, quantitive, and mathematical modeling techniques.

3.2.5 Classification based on industry

According to Ni et al. (2020), any research is incomplete unless its applications are apparent and contribute to the nation's economic development. In this regard, industries play a vital role in contributing to the economy. Correspondingly, it is essential to determine the industries in which the supply chain digitization trends are observed. Assessing supply chain digitization trends based on the industry will enable industry professionals to adopt better technologies for digitization in their specific operations. The application of industry 4.0 technologies and other digitization techniques are reported in Table 6, which shows the trends across various industries. The results in Table 6 show that the research on the manufacturing industry has the most published articles (12), followed by automotive (7), healthcare (6), logistics (6), and food and agriculture (5). Hence, the trend of supply chain digitization and industry 4.0 has become significant for the industries to grow technologically in the rapidly developing world. Besides construction, consulting, fashion, metals, and mining, non-destructive evaluation, services, and textile also experience a technological shift towards industry 4.0.

Table 6: Articles classification based on industry

S. No.	Name of Industry	No. of Articles
1	Manufacturing	12
2	Automotive	7
3	Healthcare	6
4	Logistics	6
5	Food and Agriculture	5
6	Construction	2
7	Consulting	2
8	Fashion	2
9	Metals and Mining	2
10	Non-Destructive Evaluation	2
11	Service	2
12	Textile	2
13	Army	1
14	Digital Aviation	1
15	Education	1
16	Fintech start-ups	1
17	FMCG	1
18	Heavy Engineering	1
19	Metal casting	1
20	Oil and Gas	1
21	Others	2

3.2.6 Classification based on digital technologies discussed in articles

Since the keyword considered for searching in the current research included "industry 4.0" and "supply chain digitization". The articles selected for the research mainly included the elements of industry 4.0 that are; Big Data, Cloud Computing, Additive Manufacturing / 3D printing, Cybersecurity, Simulation Optimization, Augmented Reality, Autonomous Robots, Blockchain technology, integrated

systems, and IoT were frequently discussed. Figure 5 shows the detail of articles in which these technologies and their applications are presented proportionately.

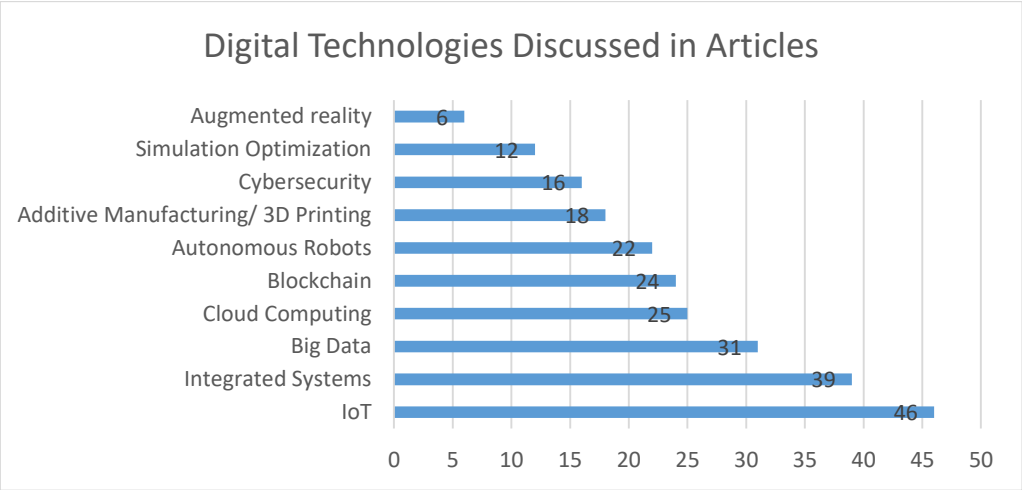


Figure 5: Digital technologies discussed in articles

In Figure 5, it is seen that IoT, integrated systems, and Big Data are discussed in most of the articles. Around 76% of articles (46) discussed the use of the Internet of Things and other technologies as a solution to the technological advancement of the supply chain. 65% of articles (39) articulated the significance of using various integrated systems for supply chain digitization. Thirty-one articles presented the application and significance of big data analytics. Correspondingly some other technologies that are explicitly discussed in the articles include cloud computing (25), blockchain technology (24), and additive manufacturing / 3D printing (18). In addition to these technologies, cybersecurity, simulation, optimization, and augmented reality were discussed in a few articles. These data facts show that the use of these technologies has significantly increased over the five years. Table 7 below shows the literature support for each of the technological trends been researched by various researchers.

Table 7: Literature support for the most trending industry 4.0 and supply chain digitization technologies

S. No.	Industry 4.0 and Digital Technologies	Literature Support
1	Big Data	(Acioli et al., 2021), (Ali et al., 2021), (Bai et al., 2021), (Barbieri et al., 2021), (Braglia et al., 2020), (Herold et al., 2021), (Dennehy et al., 2021), (Frederico, 2021), (Garay-Rondero et al., 2020), (Gremyr and Halldorsson, 2021), (Hennelly et al., 2019), (Herold et al., 2021), (Hofmann et al., 2020), (Jonsson et al., 2021), (Koh et al., 2019), (Wamba, et al., 2021), (Harris et al., 2021), (Kumar et al., 2021), (Prause et al., 2021), (Hun et al., 2021), (Kaya and Aycin, 2021), (Kamble, et al., 2021), (Zhang et al., 2021), (Wamba and Queiroz, 2021), (Vrana and Singh, 2021a), (Tezel et al., 2020), (Zhang et al., 2020), (Radanliev, et al., 2020), (Hofmann et al., 2020), (Zhao et al., 2020), (Queiroz and Mendes, 2020)
2	Cloud Computing	(Acioli et al., 2021), (Bai et al., 2021), (Barbieri et al., 2021), (Braglia et al., 2020), (Culot et al., 2021), (Garay-Rondero et al., 2020), (Gohil and Thakker, 2021), (Haddud and Khare, 2020), (Herold et al., 2021), (Jonsson et al., 2021), (Koh et al., 2019), (Ahmed, et al., 2021), (Kumar et al., 2021), (Hun et al., 2021), (Kaya and Aycin, 2021), (Vrana and Singh, 2021a), (Kamble, et al., 2021), (Zhand et al., 2021), (Sun et al., 2021), (Vrana and Singh, 2021b), (Shemov et al., 2020), (Tezel et al., 2020), (Radanliev, et al., 2020), (Radanliev, et al., 2020), (Trujillo and Hinders, 2019)

3	Additive Manufacturing / 3D printing	(Acioli et al., 2021), (Barbieri et al., 2021), (Braglia et al., 2020), (Frederico, 2021), (Garay-Rondero et al., 2020), (Ivanov et al., 2021), (Soares et al., 2021), (Vrana and Singh, 2021a), (Kamble, et al., 2021), (Zhand et al., 2021), (Çalık, 2021), (Zhao et al., 2020) (Barbieri et al., 2021), (Dennehy et al., 2021), (Garay-Rondero et al., 2020), (Haddud and Khare, 2020), (Çalık, 2021), (Zhang et al., 2020)
4	Cybersecurity	(Bai et al., 2021), (Barbieri et al., 2021), (Braglia et al., 2020), (Creazza et al. 2021), (Culot et al., 2021), (Garay-Rondero et al., 2020), (Radanliev et al., 2021), (Kumar et al., 2021), (Radanliev et al., 2021), (Soares et al., 2021), (Hun et al., 2021), (Kamble, et al., 2021), (Çalık, 2021), (Shemov et al., 2020), (Radanliev, et al., 2020), (Radanliev, et al., 2020)
5	Simulation Optimization	(Culot et al., 2021), (Dennehy et al., 2021), (Garay-Rondero et al., 2020), (Jonsson et al., 2021), (Koh et al., 2019), (Vrana and Singh, 2021a), (Kamble, et al., 2021), (Zhand et al., 2021), (Wamba and Queiroz, 2021), (Sun et al., 2021), (Çalık, 2021), (Shemov et al., 2020)
6	IoT	(Acioli et al., 2021), (Bai et al., 2021), (Barbieri et al., 2021), (Bischoff and Seuring, 2021), (Braglia et al., 2020), (Culot et al., 2021), (Dennehy et al., 2021), (Frederico, 2021), (Friday, et al., 2021), (Garay-Rondero et al., 2020), (Gohil and Thakker, 2021), (Gremyr and Halldorsson, 2021), (Haddud and Khare, 2020), (Hennelly et al., 2019), (Herold et al., 2021), (Ivanov et al., 2021), (Koh et al., 2019), (Ortt et al., 2020), (Rogerson and Parry, 2020), (Wamba, et al., 2021), (Li et al., 2021), (Radanliev et al., 2021), (Harris et al., 2021), (Kumar et al., 2021), (Radanliev et al., 2021), (Prause et al., 2021), (Soares et al., 2021), (Hun et al., 2021), (Kaya and Aycin, 2021), (Chatterjee and Chaudhuri, 2021), (Vrana and Singh, 2021a), (Kamble, et al., 2021), (Zhand et al., 2021), (Wamba and Queiroz, 2021), (Sun et al., 2021), (Çalık, 2021), (Vrana and Singh, 2021b), (Shemov et al., 2020), (Tezel et al., 2020), (Zhang et al., 2020), (Radanliev, et al., 2020), (Radanliev, et al., 2020), (Zhao et al., 2020), (Queiroz and Mendes, 2020), (Trujillo and Hinders, 2019), (Bär et al., 2018)
7	Augmented Reality	(Braglia et al., 2020), (Frederico, 2021), (Haddud and Khare, 2020), (Vrana and Singh, 2021a), (Çalık, 2021), (Vrana and Singh, 2021b)
8	Autonomous Robots	(Acioli et al., 2021), (Barbieri et al., 2021), (Braglia et al., 2020), (Frederico, 2021), (Garay-Rondero et al., 2020), (Gohil and Thakker, 2021), (Hennelly et al., 2019), (Koh et al., 2019), (Ortt et al., 2020), (Prause et al., 2021), (Soares et al., 2021), (Kaya and Aycin, 2021), (Vrana and Singh, 2021a), (Kamble, et al., 2021), (Zhand et al., 2021), (Wamba and Queiroz, 2021), (Çalık, 2021), (Vrana and Singh, 2021b), (Tezel et al., 2020), (Radanliev, et al., 2020), (Zhao et al., 2020), (Trujillo and Hinders, 2019)
9	Integrated Systems	(Bischoff and Seuring, 2021), (Braglia et al., 2020), (Creazza et al., 2021), (Culot et al., 2021), (Herold et al., 2021), (Dennehy et al., 2021), (Garay-Rondero et al., 2020), (Garza-Reyes et al., 2019), (Gohil and Thakker, 2021), (Gremyr and Halldorsson, 2021), (Hennelly et al., 2019), (Herold et al., 2021), (Hofmann et al., 2020), (Jonsson et al., 2021), (Koh et al., 2019), (Ortt et al., 2020), (Rogerson and Parry, 2020), (Wamba, et al., 2021), (Liu and Chiu, 2021), (Delesposte et al., 2021), (Dwivedi, et al., 2021), (Prause et al., 2021), (Soares et al., 2021), (Chatterjee and Chaudhuri, 2021), (Kamble, et al., 2021), (Zhand et al., 2021), (Wamba and Queiroz, 2021), (Sun et al., 2021), (Homayouni et al., 2021), (Çalık, 2021), (Shemov et al., 2020), (Tezel et al., 2020), (Zhang et al., 2020), (Zhao et al., 2020), (Golan et al., 2020), (Queiroz and Mendes, 2020), (Trujillo and Hinders, 2019), (Tikhonov et al., 2019), (Bär et al., 2018)
10	Blockchain	(Barbieri et al., 2021), (Bischoff and Seuring, 2021), (Creazza et al., 2021), (Dennehy et al., 2021), (Garay-Rondero et al., 2020), (Gohil and Thakker, 2021), (Herold et al., 2021), (Hofmann et al., 2020), (Ivanov et al., 2021), (Jonsson et al., 2021), (Koh et al., 2019), (Rogerson and Parry, 2020), (Wamba, et al., 2021), (Chatterjee and Chaudhuri, 2021), (Vrana and Singh, 2021a), (Kamble, et al., 2021), (Zhand et al., 2021), (Wamba and Queiroz, 2021), (Çalık, 2021), (Vrana and Singh, 2021b), (Shemov et al., 2020), (Tezel et al., 2020), (Zhang et al., 2020), (Queiroz and Mendes, 2020)

4. Discussion

Previous literature discussed various supply chain digitization techniques. However, non of them presented a study based on multiple parameters such as classification based on industry journal, publisher, country, research method, and research design. The current paper considered all these parameters that could be highly advantageous for both practitioners and researchers. In 2019, the awareness of industry 4.0 technologies and supply chain digitization was found to be increasingly trending. The International Journal of Operations and Production Management published a large number of articles in the selected research domain, around 8.3%. Further, the articles considered in the current research included publications that cover 23 countries worldwide. Germany and U.K.

contributed the most, with 23.4% of the total published articles according to the publication country. Around 50% of the articles adopted the literature review research method, and 18.3% used survey methods. While around 50% of the articles used a desk qualitative research design, and 31.7% used an empirical qualitative design. The manufacturing industry has the most published articles, followed by automotive, healthcare, logistics, food, and agriculture. The IoT, integrated systems and Big Data were discussed in most of the articles. Around 76% of articles discussed the use of the Internet of Things as a solution to the technological advancement of the supply chain. 65% of articles articulated the significance of the use of various integrated systems for supply chain digitization. In comparison, 31 articles presented the application and significance of big data analytics.

Therefore, social inequalities regarding the human workforce position when machines in the labor market replace these. The proposed solution is to implement the Society 5.0 or Super-Smart society concept. Organizations face severe challenges during emergency or pandemic situations, such as COVID-19. In this regard, there is a need to understand how technologies including blockchain, additive manufacturing, and artificial intelligence help organisations effectively deal with emergencies. There is a need to reinforce capabilities via supply chain digitization that will improve mechanisms for determining the optimal levels of medical inventory in the pandemic. Some components include the need to manage projects by managing and digitalizing organizations' behavior and culture, technology and human relationship in Digital Supply Chain Management, the information physical Supply Chain Network Systems and technology infrastructure, and the deployment of features and enablers of industry 4.0 technology, and maintaining physical and digital Supply Chain Flow (SCFs) for providing the right digitization. Internet of Things and other digitalization technologies increase the transparency in maintaining the medical inventory to trigger any panic. Data is considered the new oil; organizations these days are required to secure their information assets. Big data analytics enhance the capability for progressing the safety of patients in the health care industry.

5. Conclusion

Organizations face severe challenges during emergency or pandemic situations, such as COVID-19. In this regard, there is a need to understand how technologies including blockchain, additive manufacturing, and artificial intelligence help organizations effectively deal with emergencies. There is a need to reinforce capabilities via supply chain digitization that will improve mechanisms for determining the optimal levels of medical inventory in the pandemic. None of the articles used an empirical triangulation design. Empirical triangulation enables researchers to include several decision-making, quantitive techniques, and mathematical modeling techniques in the article. Eventually, the systematic review performed in the current research identified some trends that have been followed in the last five years. The most significant trends determined in the current research are the extensive use of industry 4.0 elements and blockchain to transform the traditional supply chain into a digital supply chain. Moreover, there is a need to explore society 5.0 to improve the man-machine relationship affected badly during COVID-19. Blockchain increases visibility in the supply chain by increasing transparency. Further, public blockchain can effectively support the supply chain areas lacking institutional interests. Blockchain helps organizations effectively deal with disruptive situations such as COVID-19.

6. Future Research and Limitations

The current research is carried out in the context of a systematic literature review of the empirical evidence and current studies about the elements of Industry 4.0 and the supply chain digitization trends. However, the current research allows future research to consider validating the preliminary digital supply chain models presented by experts. Also, the research recommends future work to consider real case studies from modern service providers or manufacturers. This could enable validation of the digital supply chain components and provide a headway toward emerging and new constructs in this domain. There is a need for future studies that are in collaboration with the cybersecurity domain. It is highly suggested that mathematical, decision-making and simulation techniques be included to support the research domain and increase its applicability. Multivariate techniques for data analysis were rarely seen in the reviewed articles. Several researchers used

regression and correlation analysis; however, path analysis, discriminant analysis, and ANOVA were found in a few articles. This shows that most researchers focused on simple problems and did not attempt to focus on complex industry issues. The limitation of the current research refers to the criteria followed for excluding irrelevant articles and performing a review of the appropriate literature. This includes not selecting papers in any language other than English. Also, some terms are ignored as they do not match the search protocol defined for the current research. Only two databases for research were selected for the research.

Conflict of Interest Statement: The author has no conflict of interest.

Acknowledgements: No funding was availed for this research.

References

Acioli, C., Scavarda, A., & Reis, A. (2021). Applying Industry 4.0 technologies in the COVID-19 sustainable chains. *International Journal of Productivity and Performance Management, 70*(5), 988-1016. https://doi.org/10.1108/IJPPM-03-2020-0137

Agrawal, P., & Narain, R. (2018). Digital supply chain management: An Overview. IOP Conference Series. *Materials Science and Engineering, 455*, 012074. https://doi.org/10.1088/1757-899X/455/1/012074

Al-Hinai, S., & Singh, A. V. (2017). Internet of things: Architecture, security challenges and solutions. In *International Conference on Infocom Technologies and Unmanned Systems (Trends and Future Directions)* (ICTUS) (pp. 1-4). https://doi.org/10.1109/ICTUS.2017.8286004

Ali, M., Rahman, S. M., & Frederico, G. F. (2021). Capability components of supply chain resilience for readymade garments (RMG) sector in Bangladesh during COVID-19. *Modern Supply Chain Research and Applications, 3*(2), 127-144. https://doi.org/10.1108/MSCRA-06-2020-0015

Bai, C., Martins, R. A., & Sarkis, J. (2021). Guest editorial. *Industrial Management & Data Systems, 121*(9), 1897-1914. https://doi.org/10.1108/IMDS-09-2021-762

Bär, K., Herbert-Hansen, Z. N. L., & Khalid, W. (2018). Considering Industry 4.0 aspects in the supply chain for an SME. Production Engineering, 12(6), 747-758. https://doi.org/10.1007/s11740-018-0851-y

Barbieri, P., Ellram, L., Formentini, M., & Ries, J.-M. (2021). Guest editorial Emerging research and future pathways in digital supply chain governance. *International Journal of Operations & Production Management, 41*(7) 1021-1034. https://doi.org/10.1108/IJOPM-07-2021-903

Bischoff, O., & Seuring, S. (2021). Opportunities and limitations of public blockchain-based supply chain traceability. *Modern Supply Chain Research and Applications, 3*(3), 226-243. https://doi.org/10.1108/MSCRA-07-2021-0014

Braglia, M., Marrazzini, L., Padellini, L., & Rinaldi, R. (2021). Managerial and Industry 4.0 solutions for fashion supply chains. *Journal of Fashion Marketing and Management, 25*(1), 184-201. https://doi.org/10.1108/JFMM-12-2019-0285

Çalık, A. (2021). A novel Pythagorean fuzzy AHP and fuzzy TOPSIS methodology for green supplier selection in the Industry 4.0 era. *Soft Computing, 25*(3), 2253-2265. https://doi.org/10.1007/s00500-020-05294-9

Chatterjee, S., & Chaudhuri, R. (2021). Supply chain sustainability during turbulent environment: Examining the role of firm capabilities and government regulation. *Operations Management Research*, 1-15. https://doi.org/10.1007/s12063-021-00203-1

Conner, B. P., Manogharan, G. P., Martof, A. N., Rodomsky, L. M., Rodomsky, C. M., Jordan, D. C., & Limperos, J. W. (2014). Making sense of 3-D printing: Creating a map of additive manufacturing products and services. *Additive Manufacturing, 1-4*, 64-76. https://doi.org/10.1016/j.addma.2014.08.005

Creazza, A., Colicchia, C., Spiezia, S., & Dallari, F. (2022). Who cares? Supply chain managers' perceptions regarding cyber supply chain risk management in the digital transformation era. *Supply Chain Management: An International Journal, 27*(1), 30-53. https://doi.org/10.1108/SCM-02-2020-0073

Culot, G., Nassimbeni, G., Podrecca, M., & Sartor, M. (2021). The ISO/IEC 27001 information security management standard: literature review and theory-based research agenda. *The TQM Journal, 33*(7), 76-105. https://doi.org/10.1108/TQM-09-2020-0202

Delesposte, J. E., Rangel, L. A. D., Meiriño, M. J., Narcizo, R. B., & Alencar Junior, A. A. M. de. (2021). Use of multicriteria decision aid methods in the context of sustainable innovations: bibliometrics, applications and trends. *Environment Systems & Decisions, 41*(4), 501-522. https://doi.org/10.1007/s10669-021-09814-2

Dennehy, D., Oredo, J., Spanaki, K., Despoudi, S., & Fitzgibbon, M. (2021). Supply chain resilience in mindful humanitarian aid organizations: the role of big data analytics. *International Journal of Operations & Production Management, 41*(9), 1417-1441. https://doi.org/10.1108/IJOPM-12-2020-0871

Dwivedi, A., Agrawal, D., Jha, A., Gastaldi, M., Paul, S. K., & D'Adamo, I. (2021). Addressing the challenges to sustainable initiatives in value chain flexibility: Implications for sustainable development goals. *Global Journal of Flexible Systems Management, 22*(S2), 179-197. https://doi.org/10.1007/s40171-021-00288-4

Flick, U. (2018). Doing Triangulation and Mixed Methods. Berlin: Sage. https://doi.org/10.4135/9781529716634

Frederico, G. F. (2021). Towards a Supply Chain 4.0 on the post-COVID-19 pandemic: a conceptual and strategic discussion for more resilient supply chains. *Rajagiri Management Journal, 15*(2), 94-104. https://doi.org/10.1108/RAMJ-08-2020-0047

Friday, D., Savage, D. A., Melnyk, S. A., Harrison, N., Ryan, S., & Wechtler, H. (2021). A collaborative approach to maintaining optimal inventory and mitigating stockout risks during a pandemic: capabilities for enabling healthcare supply chain resilience. *Journal of Humanitarian Logistics and Supply Chain Management, ahead-of-print(ahead-of-print)*. https://doi.org/10.1108/JHLSCM-07-2020-0061

Garay-Rondero, C. L., Martinez-Flores, J. L., Smith, N. R., Caballero Morales, S. O., & Aldrette-Malacara, A. (2019). Digital supply chain model in Industry 4.0. Journal of Manufacturing Technology Management, 31(5), 887-933. https://doi.org/10.1108/JMTM-08-2018-0280

Garza-Reyes, J. A., Kumar, V., Batista, L., Cherrafi, A., & Rocha-Lona, L. (2019). From linear to circular manufacturing business models. *Journal of Manufacturing Technology Management, 30*(3), 554-560. https://doi.org/10.1108/JMTM-04-2019-356

Gohil, D., & Thakker, S. V. (2021). Blockchain-integrated technologies for solving supply chain challenges. *Modern Supply Chain Research and Applications, 3*(2), 78-97. https://doi.org/10.1108/MSCRA-10-2020-0028

Golan, M. S., Jernegan, L. H., & Linkov, I. (2020). Trends and applications of resilience analytics in supply chain modeling: systematic literature review in the context of the COVID-19 pandemic. *Environment Systems & Decisions, 40*(2), 222-243. https://doi.org/10.1007/s10669-020-09777-w

Gremyr, I., & Halldorsson, A. (2021). Guest editorial. *Supply Chain Management: An International Journal, 26*(3), 297-306. https://doi.org/10.1108/SCM-05-2021-599

Haddud, A., & Khare, A. (2020). Digitalizing supply chains potential benefits and impact on lean operations. *International Journal of Lean Six Sigma, 11*(4), 731-765. https://doi.org/10.1108/IJLSS-03-2019-0026

Han, L., Hanping, H. Z., Yang, J., & Zheng, X. (2021). Functional Requirements and Supply Chain Digitalization in Industry 4.0. *Information Systems Frontiers*, 1-13. https://doi.org/10.1007/s10796-021-10173-1

Harris, G. A., Abernathy, D., Lu, L., Hyre, A., & Vinel, A. (2021). Bringing clarity to issues with adoption of digital manufacturing capabilities: An analysis of multiple independent studies. *Journal of the Knowledge Economy*, 1-22. https://doi.org/10.1007/s13132-021-00832-8

Hennelly, P., Srai, J., Graham, G., & Wamba, S. F. (2019). Reconfiguring business processes in the new political and technological landscape. *Business Process Management Journal, 25*(3), 386-390. https://doi.org/10.1108/BPMJ-06-2019-377

Hentout, A., Aouache, M., Maoudj, A., & Akli, I. (2019). Human-robot interaction in industrial collaborative robotics: a literature review of the decade 2008-2017. *Advanced Robotics: The International Journal of the Robotics Society of Japan, 33*(15-16), 764-799. https://doi.org/10.1080/01691864.2019.1636714

Herold, D. M., Nowicka, K., Pluta-Zaremba, A., & Kummer, S. (2021). COVID-19 and the pursuit of supply chain resilience: reactions and "lessons learned" from logistics service providers (LSPs). *Supply Chain Management. An International Journal, 26*(6), 702-714. https://doi.org/10.1108/SCM-09-2020-0439

Herold, D. M., Ćwiklicki, M., Pilch, K., & Mikl, J. (2021). The emergence and adoption of digitalization in the logistics and supply chain industry: an institutional perspective. *Journal of Enterprise Information Management, 34*(6), 1917-1938. https://doi.org/10.1108/JEIM-09-2020-0382

Hofmann, E., Brunner, J. H., & Holschbach, E. (2020). Research in business service purchasing: current status and directions for the future. *Management Review Quarterly, 70*(3), 421-460. https://doi.org/10.1007/s11301-019-00172-7

Homayouni, Z., Pishvaee, M. S., Jahani, H., & Ivanov, D. (2021). A robust-heuristic optimization approach to a green supply chain design with consideration of assorted vehicle types and carbon policies under uncertainty. *Annals of Operations Research*, 1-41. https://doi.org/10.1007/s10479-021-03985-6

Ivanov, D., Blackhurst, J., & Das, A. (2021). Supply chain resilience and its interplay with digital technologies: making innovations work in emergency situations. *International Journal of Physical Distribution & Logistics Management, 51*(2), 97-103. https://doi.org/10.1108/IJPDLM-03-2021-409

Jonsson, P., Kaipia, R., & Barratt, M. (2021). Guest editorial: The future of S&OP: dynamic complexity, ecosystems and resilience. *International Journal of Physical Distribution & Logistics Management, 51*(6), 553-565. https://doi.org/10.1108/IJPDLM-07-2021-452

Kamble, S. S., Gunasekaran, A., Subramanian, N., Ghadge, A., Belhadi, A., & Venkatesh, M. (2021). Blockchain technology's impact on supply chain integration and sustainable supply chain performance: evidence from the automotive industry. *Annals of Operations Research*, 1-26. https://doi.org/10.1007/s10479-021-04129-6

Kaya, S. K., & Aycin, E. (2021). An integrated interval type 2 fuzzy AHP and COPRAS-G methodologies for supplier selection in the era of Industry 4.0. *Neural Computing and Applications, 33*(16), 10515-10535. https://doi.org/10.21203/rs.3.rs-168876/v1

Koeppl, T. V., & Kronick, J. (2017). Blockchain Technology-What's in Store for Canada's Economy and Financial Markets? *CD Howe Institute Commentary*, 468. https://doi.org/10.2139/ssrn.2927801

Koh, L., Orzes, G., & Jia, F. J. (2019). The fourth industrial revolution (Industry 4.0): technologies disruption on operations and supply chain management. *International Journal of Operations & Production Management, 39*(6/7/8), 817-828. https://doi.org/10.1108/IJOPM-08-2019-788

Kumar, V., Vrat, P., & Shankar, R. (2021). Prioritization of strategies to overcome the barriers in Industry 4.0: a hybrid MCDM approach. Opsearch. *Quarterly Journal of the Operational Research Society of India, 58*(3), 711-750. https://doi.org/10.1007/s12597-020-00505-1

Li, X., Wang, B., Peng, T., & Xu, X. (2021). Greentelligence: Smart manufacturing for a greener future. *Chinese Journal of Mechanical Engineering, 34*(1). https://doi.org/10.1186/s10033-021-00656-2

Liu, K. P., & Chiu, W. (2021). Supply Chain 4.0: the impact of supply chain digitalization and integration on firm performance. *Asian Journal of Business Ethics, 10*(2), 371-389. https://doi.org/10.1007/s13520-021-00137-8

Manavalan, E., & Jayakrishna, K. (2019). A review of Internet of Things (IoT) embedded sustainable supply chain for industry 4.0 requirements. *Computers & Industrial Engineering, 127*, 925-953. https://doi.org/10.1016/j.cie.2018.11.030

Mohsen, A., & Woods, J. (2019). Cloud computing technology: improving small business performance using the internet. *Journal of Small Business & Entrepreneurship, 31*(6), 495-519. https://doi.org/10.1080/08276331.2018.1466850

Monteiro, S. (2017). *The fabric of interface: Mobile media, design, and gender*. MIT Press. https://doi.org/10.7551/mitpress/10633.001.0001

Ni, D., Xiao, Z., & Lim, M. K. (2020). A systematic review of the research trends of machine learning in supply chain management. *International Journal of Machine Learning and Cybernetics, 11*(7), 1463-1482. https://doi.org/10.1007/s13042-019-01050-0

Ortt, R., Stolwijk, C., & Punter, M. (2020). Implementing Industry 4.0: assessing the current state. *Journal of Manufacturing Technology Management, 31*(5), 825-836. https://doi.org/10.1108/JMTM-07-2020-0284

Prause, L., Hackfort, S., & Lindgren, M. (2020). Digitalization and the third food regime. *Agriculture and Human Values, 38*(3), 1-15. https://doi.org/10.1007/s10460-020-10161-2

Queiroz, M. M., & Mendes, A. B. (2020). Critical success factors of the Brazilian offshore support vessel industry: A flexible systems approach. *Global Journal of Flexible Systems Management, 21*(S1), 33-48. https://doi.org/10.1007/s40171-020-00239-5

Radanliev, P., De Roure, D., Ani, U., & Carvalho, G. (2021). The ethics of shared Covid-19 risks: an epistemological framework for ethical health technology assessment of risk in vaccine supply chain infrastructures. *Health and Technology, 11*(5), 1083-1091. https://doi.org/10.1007/s12553-021-00565-3

Radanliev, P., De Roure, D., Maple, C., & Ani, U. (2021). Methodology for integrating artificial intelligence in healthcare systems: learning from COVID-19 to prepare for Disease X. *AI and Ethics,* 1-8. https://doi.org/10.1007/s43681-021-00111-x

Radanliev, P., De Roure, D., Page, K., Nurse, J. R. C., Mantilla Montalvo, R., Santos, O., … Burnap, P. (2020). Cyber risk at the edge: current and future trends on cyber risk analytics and artificial intelligence in the industrial internet of things and industry 4.0 supply chains. *Cybersecurity, 3*(1). https://doi.org/10.1186/s42400-020-00052-8

Radanliev, P., De Roure, D., Walton, R., Van Kleek, M., Montalvo, R. M., Maddox, L., … Anthi, E. (2020). Artificial intelligence and machine learning in dynamic cyber risk analytics at the edge. *SN Applied Sciences, 2*(11). https://doi.org/10.1007/s42452-020-03559-4

Reardon, T., Belton, B., Saweda, O. L., Lu, L.-T. L., Nuthalapati, C. S., Tasie, O., & Zilberman, D. (2021). E-commerce's fast-tracking diffusion and adaptation in developing countries. *Applied Economic Perspectives and Policy, 43*(4), 1243-1259. https://doi.org/10.1002/aepp.13160

Ren, S., Zhao, X., Huang, B., Wang, Z., & Song, X. (2019). A framework for shopfloor material delivery based on real-time manufacturing big data. *Journal of Ambient Intelligence and Humanized Computing, 10*(3), 1093-1108. https://doi.org/10.1007/s12652-018-1017-7

Rogerson, M., & Parry, G. C. (2020). Blockchain: case studies in food supply chain visibility. *Supply Chain Management: An International Journal, 25*(5), 601-614. https://doi.org/10.1108/SCM-08-2019-0300

Shemov, G., Garcia de Soto, B., & Alkhzaimi, H. (2020). Blockchain applied to the construction supply chain: A case study with threat model. *Frontiers of Engineering Management, 7*(4), 564-577. https://doi.org/10.1007/s42524-020-0129-x

Shukor, A. A. A., Newaz, M. S., Rahman, M. K., & Taha, A. Z. (2021). Supply chain integration and its impact on supply chain agility and organizational flexibility in manufacturing firms. *International Journal of Emerging Markets, 16*(8), 1721-1744. https://doi.org/10.1108/IJOEM-04-2020-0418

Soares, M. C., Ferreira, C. V., & Murari, T. B. (2021). Supply chain resilience and industry 4.0: a evaluation of the Brazilian northeast automotive OEM scenario post COVID-19. *AI Perspectives, 3*(1). https://doi.org/10.1186/s42467-021-00010-1

Sun, N., Kopper, A., Karkare, R., Paffenroth, R. C., & Apelian, D. (2021). Machine learning pathway for harnessing knowledge and data in material processing. *International Journal of Metalcasting, 15*(2), 398-410. https://doi.org/10.1007/s40962-020-00506-2

Tezel, A., Papadonikolaki, E., Yitmen, I., & Hilletofth, P. (2020). Preparing construction supply chains for blockchain technology: An investigation of its potential and future directions. *Frontiers of Engineering Management, 7*(4), 547-563. https://doi.org/10.1007/s42524-020-0110-8

Tikhonov, A. I., Sazonov, A. A., & Novikov, S. V. (2019). Digital aviation industry in Russia. *Russian Engineering Research, 39*(4), 349-353. https://doi.org/10.3103/S1068798X19040178

Trujillo, V. E., II., & Hinders, M. K. (2019). Container monitoring with infrared catadioptric imaging and automatic intruder detection. *SN Applied Sciences, 1*(12). https://doi.org/10.1007/s42452-019-1721-8

Vaidya, S., Ambad, P., & Bhosle, S. (2018). Industry 4.0-a glimpse. *Procedia Manufacturing, 20,* 233-238. https://doi.org/10.1016/j.promfg.2018.02.034

Vrana, J., & Singh, R. (2021a). Cyber-physical loops as drivers of value creation in NDE 4.0. *Journal of Nondestructive Evaluation, 40*(3), 61. https://doi.org/10.1007/s10921-021-00793-7

Vrana, J., & Singh, R. (2021b). NDE 4.0-A design thinking perspective. *Journal of Nondestructive Evaluation, 40*(1), 8. https://doi.org/10.1007/s10921-020-00735-9

Wamba, S. F., & Queiroz, M. M. (2021). Responsible Artificial Intelligence as a Secret Ingredient for Digital Health: Bibliometric Analysis, Insights, and Research Directions. *Information Systems Frontiers,* 1-16.

Wamba, S. F., Queiroz, M. M., Roscoe, S., Phillips, W., & Kapletia, D. (2021). Guest editorial Emerging technologies in emergency situations. *International Journal of Operations & Production Management, 41*(9), 1405-1416. https://doi.org/10.1108/IJOPM-09-2021-904

Weltzien, C. (2016). Digital agriculture or why agriculture 4.0 still offers only modest returns. *Landtechnik, 71*(2), 66-68.

Zhang, C., Chen, Y., Chen, H., & Chong, D. (2021). Industry 4.0 and its implementation: A review. *Information Systems Frontiers*, 1-11. https://doi.org/10.1007/s10796-021-10153-5

Zhang, Q., Liao, B., & Yang, S. (2020). Application of blockchain in the field of intelligent manufacturing: Theoretical basis, realistic plights, and development suggestions. *Frontiers of Engineering Management, 7*(4), 578-591. https://doi.org/10.1007/s42524-020-0137-x

Zhao, J., Ji, M., & Feng, B. (2020). Smarter supply chain: a literature review and practices. *Journal of Data, Information and Management, 2*(2), 95-110. https://doi.org/10.1007/s42488-020-00025-z

Zhao, S., Li, S., Qi, L., & Xu, L. D. (2020). Computational intelligence enabled cybersecurity for the internet of things. *IEEE Transactions on Emerging Topics in Computational Intelligence, 4*(5), 666-674. https://doi.org/10.1109/TETCI.2019.2941757

South Asian Journal of Social Review
2022 Vol. 1, No. 1, pp. 42-52
DOI: 10.57044/SAJSR.2022.1.1.2204

Supply Chain Management Practices and Organizational Performance in Manufacturing Industry

Masroor Alam [1*]

[*1] *Researcher, Department of Business Administration, Iqra University, Karachi, Pakistan*

**Corresponding Author Email: masroor_alam00@hotmail.com*

Article History

Received: 18 April 2022
Revised: 28 June 2022
Accepted: 29 June 2022
Published: 30 June 2022

JEL Classification
J20
J22
R41
L60

ABSTRACT

The study aims to evaluate the impact of supply chain management practices on the organizational performance in Manufacturing firms. The methodology included a quantitative approach and explanatory type with convenience sampling and linear regression analysis using a sample of 200 respondents working at various manufacturing firms in Karachi-Pakistan. The study found that strategic supplier partnership, knowledge management capability, and customer relationship significantly influence organizational performance. Since there were only limited observations, the revalidation of variables was not done in this study. Secondly, a complex supply chain management concept includes companies' networks to produce and deliver the final output. Thus the overall domain was not studied in this research. Future research could be done on the higher-order model using the same constructs to find the in-depth relationship between independent variables and the dependent variable using a complex statistical technique.

Keywords: *Strategic supplier partnership, Knowledge management capability, Customer relationship, Pakistan*

Citation of this article:

Alam, M. (2022). Supply Chain Management Practices and Organizational Performance in Manufacturing Industry. *South Asian Journal of Social Review, 1*(1), 42-52 https://doi.org/10.57044/SAJSR.2022.1.1.2204

Supply Chain Management Practices and Organizational Performance in Manufacturing Industry

1. Introduction

In Supply chain management, the most significant thing can be done to improve performance and maintain a competitive edge in the market. This is because supply chain management is critical and can be employed beneficially. This is how the process goes. They have maintained their position as competitive players in the market since SCM rivalry among the organizations has been enhanced. In the early 1990s, the global market became subject to intense rivalry to deliver the appropriate goods or services at a price comparable to those of competitors at the appropriate time and in the appropriate location (Liu & Atuahene-Gima, 2018). Enterprises must not only restructure themselves to produce higher quality services and products but also reduce waste and respond to the market needs. However, it is used to manage its supply chains effectively due to numerous competing expanding companies both globally and locally. Businesses must overcome a range of challenges in order to compete in today's competitive global marketplaces.

For businesses to continue to be competitive partners, they need to acknowledge the significance of supply chain strategies that improve not just their businesses' performance but also their supply chains' overall performance. Despite significant advances made in research and practice, a great number of companies are still having trouble understanding the notion. The difficulties arise from coordinated planning and supply operations among supply network participants (Baloch & Rashid, 2022; Rashid & Rasheed, 2022). Although companies can obtain common resources, their ability to deploy and configure them can provide differentiation and diversity (Anwar, 2022). Internal and external organizational resources that might assist a company in acquiring a competitive advantage and improving performance are called organizational capabilities (Amjad, 2022). Knowledge is an essential strategic resource for organizational survival, growth, stability and development (Al-Hakim & Hassan, 2016).

Furthermore, knowledge is the foundation for developing critical competencies that will help organizations gain a competitive advantage and increase performance (Hunaid et al., 2022). Organizations would benefit from knowledge management (KM) by information sharing with external partners to gather information about the competitors' services, products, techniques, and best practices (Shaheen, 2022). Organizations must interact and create long-term relationships with downstream and upstream supply chain partners for enhancing their performances and thriving in a competitive climate (Xu et al, 2014). Managing knowledge is seen as a critical strategic advantage that helps organizations achieve their goals in supply chain members' coordination and integration (Rasheed, 2022). Organizational performance was a continual process of several activities, not just an outcome.

Capabilities were the effort to carry out activities and procedures that led to organizational performance. Three standard points and a balance score were criteria to assess the organization's success. The first is the customer, the second is the process of internal business (capabilities), and the third is the organization's growth and learning. By establishing a solid relationship between the company and the customer, thus, customer relationship management was the key to increasing revenue and profit. Customer relationship management also helps to build and maintain customer-company trust. Satisfaction, loyalty, cross- and up-selling, repeat purchases, decreased customer complaints, high market share, lower expenses, and profitability all contributed to this trust (Ogilvie et al., 2018). Thus, it has been hypothesized that supply chain disruptions have an essential and detrimental effect on overall performance and productivity.

The continuous variations also entail that the organizations work with the increased volume and great information diversity. Thus the organizational managers are concerned with the quality improvement in the information they have for decisions and planning purposes. Most firms also have

to goal the changing needs of customers and the instabilities of the environment. However, many disturbances can damage production and its process, just like the changes in demand patterns, breakdowns of machines, fluctuations in finances and many others. Thus the variable of uncertainty should also be focused on (Ali, 2022). Other firms are increasingly adopting the strategic supplier partnership to develop Inter-organizational collaboration in their supply chain. There are some main challenges and successes that all are connected with how they handle and administer the inventory level. It also depends on how it affects the satisfaction of customers since it remains unknown how the collaboration of partners and companies with different Venders and suppliers affects organizational performance and the supply chain (Victory et al., 2022). The study aims to investigate the practices of supply chain management and organizational performance. To achieve this objective, we have some specific objectives required to fulfil the study's primary objective. Based on the study research problem and research objectives, this study will specifically seek answers given below:

R1: Does the strategic supplier partnership influences organizational performance?

R2: Does the knowledge management capability influences organizational performance?

R3: Does the customer relationship influences organizational performance?

2. Literature Review

2.1 Strategic Supplier Partnership and Organizational Performance

The strategic supplier partnerships functions and how they impact the supply chain integration, SC performance, and farmer performance. His present research is focused on Indonesia, specifically the province of East Java. He got a final sample of 200 responses, which he utilized to analyze the data. According to the data, SSP was shown to be ineffectively linked with all parameters not studied. SC integration, however, was discovered to be a strong and favourable link between SC and farmer performance. Furthermore, the performance of the farmers was found to be influenced by the performance of the SC. The essential aspects in enhancing their performance and development were improvements in SC integration and management. Further, the researchers examined the extent to which SCM practices are used in Haco Industries Ltd, as well as the relationship between the performance of the organization and SCM practices in the same industries. The supply chain management practices and organizational performance relationship were investigated using four key dimensions of supply chain management practices as independent variables. These key dimensions were "*information sharing, customer relationship, supplier partnership, strategic and training (practices)".* Market/business and operational performance have different approaches to investigating organizational performance. We chose forty workers at random to act as our sample. A questionnaire was used as a study technique, which allowed for the information to be acquired systematically. A handful of critical informants were responsible for collecting both primary and secondary data. Thus, the collected data was analyzed using SPSS XVIII. Frequency and average score, the study's main findings revealed that Haco Industries. In addition, Haco Industries have a higher focus on the practical implementation of SCM practices, and they have been successful in enhancing the organizational performance by reducing lead time; providing higher levels of customer service, lowering operational costs, providing a quality product, responding quickly to market changes, and expanding market share and sales. Thus all four practices had a more substantial influence on the organization's performance than any single practice, illustrating the value of embracing a diverse set of SCM procedures.

H1: Strategic supplier partnership has a significant influence on organizational performance.

2.2 Knowledge Management Capability and Organization Performance

Salama (2017) analyzed Knowledge Management Capability in depth. A company's KM competency is its ability to acquire, develop, and maintain knowledge. The research method used in this study was an empirical assessment of the hypothesized correlations among research variables

utilizing self-administered questionnaires. There are 63 factories with over 100 employees in New Borg Al-Arab industrial city. This study's key finding show that knowledge management skills are essential for predicting organizational learning and supply chain coordination Members of the supply chain have different management practices. Furthermore, it is evaluated that the factories under research have other factors such as knowledge management capabilities and impact supply chain management practices and organizational learning. To continuously develop new knowledge, execute knowledge-related resources integrate, share, transfer, and knowledge transfer (Tseng & Lee, 2014). This brought a long-term competitive advantage to the firms while increasing the organization's effectiveness. According to the firm's knowledge-based and resource-based viewpoint, this research looks at KM infrastructure capability from a socio-technical standpoint. The combination of social infrastructure and technology is viewed as a source of strategic assets in this approach.

H2: Knowledge management capability has a significant effect on organizational performance.

2.3 Customer Relationship and Organization Performance

The concept of customer relationship (CR) is based on a client's level of satisfaction with services and how and to what extent their complaints about products are addressed to keep their loyalty and meet their expectations. Furthermore, businesses have directed their executives to focus on developing CR in order to engage customers in their services and achieve high levels of customer happiness and practice (Wang & Kim, 2017). According to (Yihdego et al., 2019), positive CR helps managers boost their business and develop a firm basis on which to improve organizational performance. It is defined as the prospect of SC in which it develops loyalty, trust and integration to work with collaboration between the partners to have long-term sustainable performance and the customers.

H3: Customer relationship has a significant effect on organizational performance.

2.4 Underpinning and Supporting Theories

The resource-based view tells that the organizations have resources strategists select the strategy or competitive position. A subset allows them to obtain a competitive advantage and leads to superior long-term performance. Valuable and rare resources can be utilized to gain a competitive advantage. In SCM, the resource-based view (RBV) (Hashmi et al., 2021) helps companies create agility, adaptation, and alignment. As a result, we may conclude that the RBV theory promotes strategic supplier partnerships, supply chain practices, and firm performance by allowing us to establish strong norms while also increasing our purchasing power.

Further, from the knowledge-based perspective of the business, knowledge is considered the resource with the most significant strategic significance for a company. Its proponents say that diverse knowledge bases and abilities across firms are the most significant predictors of long-term competitive advantage and better corporate performance since knowledge-based resources are challenging to copy and socially complex. This information is entrenched in and carried by several different entities, including corporate culture and identity, rules, procedures, documents, and systems and personnel. The knowledge-based theory of the firm's basic tenet is that organizations can handle knowledge more effectively than feasible using other organizational structures. This is the principle that underpins the existence of organizations. However, organizations are social entities that use and preserve internal knowledge, skills, and capacities that are essential to the company's continued existence, expansion, and success. The idea emphasizes the significance of exceptional organizational coordination and the integration of employee learning.

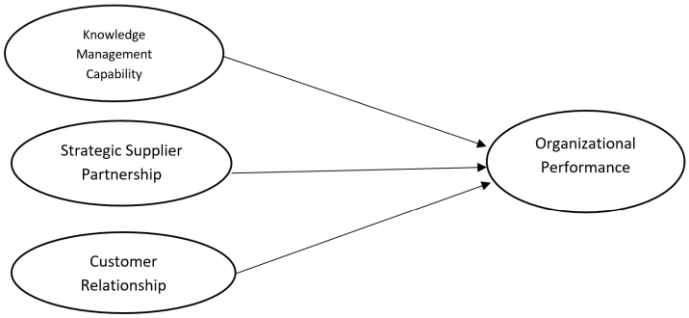


Figure 1: A research framework

3. Research Methodology

There are quantitative and qualitative research approaches. With the quantitative research technique, data gathering and analysis are conducted with the use of statistics (Rashid, 2016; Rashid & Amirah, 2017; Rashid et al., 2019). Quantitative data does not gather exhaustive information from participants but utilizes many of them to generalize the findings. The objective of data evaluation is to establish a relationship between variables and the acceptance or rejection of the study hypothesis. The quantitative technique gathers data objectively, enabling the data to be minimized (Agha et al., 2021; Haque et al., 2021; Khan et al., 2021; Khan et al., 2022). Explanatory research facilitates the discovery of comprehensive findings and the presentation of a thorough explanation of the research topic. The explanatory research assesses the variables representing people's behaviour and their actions and provides details regarding the conditions where they can be impacted (Alrazehi et al., 2021; Das et al., 2021; Rashid et al., 2021). Since the study is confirming a theory, the study applies explanatory research as the research type. There are two types of research designs: correlation research and causal study. In theory, the correlation research design assesses the association between the investigation variables. However, the cause-and-effect relationship is explored by the causal research design between the study's variables.

3.1 Sampling Design and Target Population

One of the contributing manufacturing industries of Pakistan is the textile and other Steel structures and automobile sector company's industry. While it has massive supply chain practices and mechanisms, it was somewhat less efficient in its processes. Henceforth, the study is undertaken its importance and taken as a research population to understand the position of supply chain management practices on the operational performance of manufacturing companies in Pakistan. However, the data was collected from the supply chain professionals of different firms in Karachi, Pakistan. Therefore, the population for this study was the Pakistani manufacturing sector which is expanded to over 2000 manufacturing firms as of 2015. (Khan et al., 2016). Respondents from the manufacturing firms belonged to managerial positions. They were chosen because managerial-level respondents would actually possess more knowledge and know-how of the firm's supply chain. One of the manufacturing industries that offer Pakistan is the textile industry while it has a big supply chain and practices but has found that it does not work well in its processes. Thus, the data was collected from the logistics specialists of Karachi, Pakistan's textile, Steel structure, and automobile sector companies.

3.2 Sampling Technique and Sample Size

For the objective of the present study, a sample of manufacturing businesses was selected. The author of this study decided to use a method that was not based on probability in order to obtain data from a substantial number of internet users for their study. Because of the large size of the population, the limited amount of available time, and the available resources, the author used the convenience sampling method (Uyanık et al., 2015). This method is regarded as an appropriate sample approach in such situations.

For the purpose of data collection, the study has used the "50+8*k* formula" (Tabachnick &

Fidell, 2007), where "*k"* denotes the total number of variables in the model. Thus, there were four variables in the model and a minimum of 82 respondents were required. Whereas, this study collected data from 200 respondents to facilitate the generalizability of research findings. Respondents from the manufacturing firms belonged to managerial positions. They were chosen because managerial-level respondents would possess more knowledge and know-how of the firm's supply chain.

3.3 Data Collection

For a collection of data purpose, the study used an interactive questionnaire to collect data from sample people using a five-point Likert questionnaire. The use of variables is presented in the table above; the primary data sources were intended for data collection according to preliminary responses from the different manufacturing industry specialists in Karachi, Pakistan.

In regards to data analysis, the study has employed KMO and Bartlett's Test from reliability analysis and multiple linear regression analysis. The goal of linear regression analysis is to test a hypothesis between two or more independent variables and one dependent variable. Herein, these assumptions were met in the model and therefore, multiple regression analysis has been used for primary data analysis for inferential statistics.

4. Data Analysis

Two hundred fifty questionnaires were distributed to individuals working in manufacturing companies in Karachi, Pakistan. A total of 200 responses were collected, which is an 80.6% response rate. The descriptive statistics were carried out to check the univariate normality of the data. It contains mean, standard deviation, skewness and kurtosis. The acceptable range of skewness and kurtosis is +2.5 (Awang, 2015). The consolidated outcomes for descriptive statistics are presented in given Table 1:

Table 8: Descriptive statistics

Construct	Mean	Std. Dev.	Skewness	Kurtosis
Knowledge management capability	3.56	0.71	-.543	.688
Customer relationship	3.59	0.60	-.470	.916
Organizational performance	3.52	0.77	-.924	.982

Source: SPSS output

According to results presented in given above table, the maximum skewness value (sk=0.924) is for construct Organizational performance (OP) (Mean = 3.52, S.D=0.77) while the minimum skewness value (sk= 0.470) is for construct Customer relationship (CR) (Mean=3.59, S.D=0.60). On the other hand, the maximum value of kurtosis (k=0.982) is for construct Organizational performance (OP) (Mean = 3.52, S.D=0.77) while the smallest value of kurtosis (k=0.448) is for construct Strategic supplier partnership (SSP) (Mean = 3.34, S.D=0.71). Since these outcomes indicate that the skewness and kurtosis value for all constructs are not greater than +2.5, the univariate normality was established.

Reliability analysis was ascertained to eliminate the data-related error and examine the internal consistency of data. The acceptable value of reliability is at least 0.70 or greater (Hult et al., 2018; Hashmi & Mohd, 2020; Hashmi et al., 2020a, b). The given above shows that the maximum reliability value (Alpha=0.765) is for construct Organizational performance (OP) (Mean = 3.52, S.D=0.77) whereas the minimum value of reliability (Alpha = 0.701) is for construct Knowledge management capability (KMC) (Mean = 3.56, S.D=0.754). Therefore, all reliability values are no less than 0.70, so all adapted constructs are reliable for this study. Table 2 illustrates the summarized results for reliability analysis.

Table 9: Reliability analysis

Construct	Standardized Cronbach's Alpha s	Mean	Standard Deviation
Knowledge management capability	.701	3.56	0.71
Customer relationship	.713	3.59	0.60
Organizational performance	.765	3.52	0.77

Source: SPSS output

The correlation analysis was applied to check the inter-construct relationship's strength, highlighting the construct's uniqueness and multicollinearity issue. The acceptable value of correlation should be in the range of +0.30 to +0.90 (O'Brien & Sharkey Scott, 2012). The summarized calculated outcomes for correlation analysis are presented in given below Table 4:

Table 10 Bivariate correlation

Construct	T_SSP	T_KMC	T_CR	T_OP
Strategic supplier partnership	1			
Knowledge management capability	.573**	1		
Customer relationship	.452**	.542**	1	
Organizational performance	.304**	.494**	.402**	1

*Source: SPSS output; ** Correlation is significant at the 0.01 level (2-tailed).*

The calculated results presented in given above table indicate that the strongest association (r=0.573) is among Knowledge management capability (KMC) (Mean = 3.56, S.D=0.754) and Strategic supplier partnership (SSP) (Mean = 3.34, S.D=0.71). On the other hand the weakest association (r=0.304) is among organizational performance (OP) (Mean = 3.52, S.D=0.77) and Strategic supplier partnership (SSP) (Mean = 3.34, S.D=0.71). These results show that all correlation values are in the acceptable range, so it was assumed that all constructs measure distinct concepts.

4.1 Hypothesis Testing

The hypotheses *H1, H2, and H3* were tested by simple regression analysis. The results for hypothesis *H1* suggested that the predictor "strategic supplier partnership" predicted 8.8% of the variance in "organizational performance". While, for hypothesis *H2,* the predictor "knowledge management capability" predicted 24.4% of the variance in "organizational performance". Besides, for hypothesis *H3,* the predictor "customer relationship" predicted a 15.7% of the variance in "organizational performance".

The ANOVA results illustrated a significant value of 0.000 < 0.05, indicating that "strategic supplier partnership", "knowledge management capability", and "customer relationship" have a statistically significant relationship with "organizational performance". Moreover, the beta coefficients presented a significant value (> 0.05) which indicates that "strategic supplier partnership" has a significant influence on "organizational performance". Moreover, the beta value for *H1* is 0.304, which illustrates that if the "strategic supplier partnership" increases by a single unit, then the "organizational performance" will be significantly enhanced by 0.304 units. Thus, hypothesis *H1* was supported. However, the beta value for *H2* is 0.494 which illustrates that if the "knowledge management capability" increases by a single unit, then the "organizational performance" will be significantly enhanced by 0.494 units. Thus, hypothesis *H3* was supported. Lastly, the beta value for *H3* is 0.402, which illustrates that if the "customer relationship" increases by a single unit, then the "organizational performance" will be significantly enhanced by 0.402 units. Hence, hypothesis *H3* was supported.

5. Summary and Conclusion

This particular research aimed to investigate the impact of supply chain management on the performance of manufacturing firms in Karachi, Pakistan. The study was mainly supported by the existing research studies such as Resource-based view theory, Knowledge-based theory & goal-setting theory. The research framework of this study was applied to the manufacturing firms of Karachi. The target population of the research are the individuals working in managerial positions in the supply chain department. A population sample size was calculated using the 50 + 8k formula (Tabachnick & Fidell, 2007), wherein denotes the total number of variables in the model. Thus, on the basis of no. of a variables sample size of a minimum of 100 respondents is calculated to collect the data from respondents. A structured questionnaire was developed that was circulated among respondents. After receiving data from respondents, data were analyzed by using SPSS software. After analyzing the data,

it was found that all proposed hypothesis was retained. The following literature showed that all the variables were significantly associated with and positively influenced firm performance. However, according to the data analysis, it was confirmed that Strategic supplier partnerships & Customer relationships have a positive and significant influence on firm performance.

All the proposed hypotheses were tested, and it was found that two hypotheses were retained. The recent results and outcomes of the research study are further discussed in given below section. Hypothesis one, "Strategic supplier partnership has significant & positive impact on organizational performance." was rejected and had insignificant results. Hypothesis two, "Knowledge management capability has significant & positive impact on organizational performance." was retained and answered to research question two: Does the Knowledge management capability impact organizational performance? Was it match with existing literature? For instance, knowledge management capabilities, have an impact on organizational learning and supply chain management practices. To continuously develop new knowledge, transfer, integrate, share, and apply knowledge-related resources and activities across functional boundaries (Chuang, 2004). This would enable the firm to achieve a long-term competitive advantage while increasing organizational effectiveness (Tseng & Lee, 2014). Hypothesis three, "Customer relationship has significant & positive impact on organizational performance", was retained and answer to research question three: Does Customer relationship impact organizational performance? Was it match with existing literature? According to Yihdego et al. (2019), positive CR helps managers boost their business and develop a firm basis on which to improve organizational performance.

6. Research Implications, Limitations, and Recommendations

On the basis of empirical findings implication for managers of the firm is that it provides the direction of increasing and enhancing the performance of an organization through adopting SCM practice and making strategies on the basis of these factors to enhance its performance. It would also provide rationale points for implementing or initiating a reliable supply chain practice in manufacturing firms by providing specific supply chain practices and their discrete impact on firm performance. There are certain limitations which were not considered in this study, and these limitations are required to be considered in future research to fill these gaps. This study also brings some recommendations to minimize the limitations of the research. Thus few limitations and recommendations are as follows; First, this study focus on the influence of supply chain management practices on organization performance. Future studies suggest extending this research model by adding quality dimensions for supply chain practices and examining their influence on organization performance. Moreover, this study is limited to the direct impact of SCM practices on organization performance, so in future studies, it can also be extended by delving into the indirect impact of SCM practices by adding a mediator or moderator (i.e. competitive advantage as a moderator). Furthermore, this model can be more refined if the structural equation model (SEM) is done on it; through the SEM model, it can be found whether SCM practice effects are more or more substantial and which factors require more concentration. Second, this study only considers the manufacturing sector in Karachi. To make this model more generalized, it should have applied to other industries and cities in the country. Due to the limitation of the time framework, the data was collected from a smaller sample size. The sample size should also increase in future studies to get more accuracy in results. Third, this research finds a direct relationship between SCM practices and organizational performance, but the level of quality performance of an organization was not considered. So it is suggested that researchers incorporate the quality performance dimension besides the organization performance and also determine a comparative analysis of both performance dimensions.

References

Agha, A. A., Rashid, A., Rasheed, R., Khan, S., & Khan, U. (2021). Antecedents of Customer Loyalty at Telecomm Sector. *Turkish Online Journal of Qualitative Inquiry*, *12*(9), 1352-1374.

Al-Hakim, L. A., & Hassan, S. (2016). Core requirements of knowledge management implementation, innovation and organizational performance. *Journal of Business Economics and Management, 17*(1), 109-124. https://doi.org/10.3846/16111699.2012.720597

Ali, S. B. (2022). Industrial Revolution 4.0 and Supply Chain Digitization. *South Asian Journal of Social Review, 1*(1), 21-41. https://doi.org/10.57044/SAJSR.2022.1.1.2205

Alrazehi, H. A. A. W., Amirah, N. A., Emam, A. S., & Hashmi, A. R. (2021). Proposed model for entrepreneurship, organizational culture and job satisfaction towards organizational performance in International Bank of Yemen. *International Journal of Management and Human Science, 5*(1), 1-9.

Amjad, S. (2022). Role of Logistical Practices in Quality Service Delivery at Supermarkets: A Case Study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 39-56. https://doi.org/10.57044/SAJOL.2022.1.1.2204

Anwar, M. F. A. (2022). The Influence of Inter-Organizational System Use and Supply Chain Capabilities on Supply Chain Performance. *South Asian Journal of Operations and Logistics, 1*(1), 20-38. https://doi.org/10.57044/SAJOL.2022.1.1.2203

Baloch, N. & Rashid, A. (2022). Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis. *South Asian Journal of Operations and Logistics, 1*(1), 1-13. https://doi.org/10.57044/SAJOL.2022.1.1.2202

Chuang, S. H. (2004). A resource-based perspective on knowledge management capability and competitive advantage: an empirical investigation. *Expert Systems with Applications, 27*(3), 459-465. https://doi.org/10.1016/j.eswa.2004.05.008

Das, S., Ghani, M., Rashid, A., Rasheed, R., Manthar, S., & Ahmed, S. (2021). How customer satisfaction and loyalty can be affected by employee's perceived emotional competence: The mediating role of rapport. *International Journal of Management, 12*(3), 1268-1277. DOI: 10.34218/IJM.12.3.2021.119.

Fornell, C. (1981). Structural equation models with unobservable variables and measurement error: algebra and statistics. *Journal of Marketing Research,18*(3), 382-388. https://doi.org/10.1177/002224378101800313

Haque, I., Rashid, A., & Ahmed, S. Z. (2021). The Role of Automobile Sector in Global Business: Case of Pakistan. *Pakistan Journal of International Affairs. 4*(2), 363-383. https://doi.org/10.52337/pjia.v4i2.195

Hashmi, A. R., & Mohd, A. T. (2020). The effect of disruptive factors on inventory control as a mediator and organizational performance in Health Department of Punjab, Pakistan. *International Journal of Sustainable Development & World Policy, 9*(2), 122-134. https://doi.org/10.18488/journal.26.2020.92.122.134

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020a). Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan. *Management Science Letters, 11*(1), 77-86. https://doi.org/10.5267/j.msl.2020.8.028

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020b). Mediating effect of integrated systems on the relationship between supply chain management practices and public healthcare performance: Structural Equation Modeling. *International Journal of Management and Sustainability, 9*(3), 148-160. https://doi.org/10.18488/journal.11.2020.93.148.160

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2020). Exploring the dimensions using exploratory factor analysis of disruptive factors and inventory control. *The Economics and Finance Letters, 7*(2), 247-254. https://doi.org/10.18488/journal.29.2020.72.247.254

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021). Mediation of inventory control practices in proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management, 9*(1), 89-98. https://doi.org/10.5267/j.uscm.2020.11.006

Hult, G. T. M., Hair, J. F., Proksch, D., Sarstedt, M., Pinkwart, A., & Ringle, C. M., (2018). Addressing endogeneity in international marketing applications of partial least squares structural equation modeling. *Journal of International Marketing, 26*(3), 1-21. https://doi.org/10.1509/jim.17.0151

Hunaid, M., Bhurgri, A. A., & Shaikh, A. (2022). Supply Chain Visibility in Leading Organizations of the Shipping Industry. *South Asian Journal of Social Review, 1*(1), 8-20. https://doi.org/10.57044/SAJSR.2022.1.1.2202

Salama, I. E. E. (2017). The impact of knowledge management capability, organizational learning, and supply chain management practices on organizational performance. *The Business & Management Review, 8*(5), 37-51.

Khan, M. A., Ngo, H. H., Guo, W. S., Liu, Y., Nghiem, L. D., Hai, F. I., ... & Wu, Y. (2016). Optimization of process parameters for production of volatile fatty acid, biohydrogen and methane from anaerobic digestion. *Bioresource Technology, 219*, 738-748. https://doi.org/10.1016/j.biortech.2016.08.073

Khan, S. K., Ahmed, S., & Rashid, A. (2021). Influence of social media on purchase intention and customer loyalty of generation Y with the mediating effect of conviction: a case of Pakistan. *Pakistan Journal of International Affairs. 4*(2), 526-548. https://doi.org/10.52337/pjia.v4i2.207

Khan, S., Benhamed, A., Rashid, A., Rasheed, R., & Huma, Z. (2022). Effect of leadership styles on employees' performance by considering psychological capital as mediator: evidence from airlines industry in emerging economy. *World Journal of Entrepreneurship, Management and Sustainable Development, 18*(8). https://wasdlibrary.org/publications/journals/wjemsd/

Khan, S., Rasheed., R., & Rashid, A., Abbas, Q., & Mahboob, F. (2022). The Effect of Demographic Characteristics on Job Performance: An Empirical Study from Pakistan. *Journal of Asian Finance, Economics and Business, 9*(2), 283-294. https://doi.org/10.13106/jafeb.2022.vol9.no2.0283

Khan, S., Rashid, A., Rasheed, R., & Amirah, N. A. (2022). Designing a knowledge-based system (KBS) to study consumer purchase intention: the impact of digital influencers in Pakistan. *Kybernetes, 51*(1). https://doi.org/10.1108/K-06-2021-0497

Liu, W. & Atuahene-Gima, K. (2018). Enhancing product innovation performance in a dysfunctional competitive environment: The roles of competitive strategies and market-based assets. *Industrial Marketing Management, 73*, 7-20. https://doi.org/10.1016/j.indmarman.2018.01.006

Ogilvie, J., Agnihotri, R., Rapp, A., & Trainor, K. (2018). Social media technology use and salesperson performance: A two study examination of the role of salesperson behaviors, characteristics, and training. *Industrial Marketing Management, 75*, 55-65. https://doi.org/10.1016/j.indmarman.2018.03.007

Rasheed, T. (2022). Supply Chain Sustainability Through Green Practices in Manufacturing: A Case Study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 57-71. https://doi.org/10.57044/SAJOL.2022.1.1.2205

Rashid, A. & Rasheed, R. (2022). A Paradigm for Measuring Sustainable Performance Through Big Data Analytics-Artificial Intelligence in Manufacturing Firms. Available at SSRN 4087758. https://doi.org/10.2139/ssrn.4087758

Rashid, A. (2016). Impact of inventory management in downstream chains on customer satisfaction at manufacturing firms. *International Journal of Management, IT and Engineering, 6*(6), 1-19.

Rashid, A., & Amirah, N. A. (2017). Relationship between poor documentation and efficient inventory control at Provincial Ministry of Health, Lahore. *American Journal of Innovative Research and Applied Sciences, 5*(6), 420-423.

Rashid, A., Amirah, N. A., & Yusof, Y. (2019). Statistical approach in exploring factors of documentation process and hospital performance: a preliminary study. *American Journal of Innovative Research and Applied Sciences, 9*(4), 306-310.

Rashid, A., Amirah, N. A., Yusof, Y., & Mohd, A. T. (2020). Analysis of demographic factors on perceptions of inventory managers towards healthcare performance. *The Economics and Finance Letters, 7*(2), 289-294. https://doi.org/10.18488/journal.29.2020.72.289.294

Rashid, A., Rasheed, R., Amirah, N. A., Yusof, Y., Khan, S., & Agha, A., A. (2021). A Quantitative Perspective of Systematic Research: Easy and Step-by-Step Initial Guidelines. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 2874-2883.

Shaheen, S. (2022). Quality management and operational performance: a case study from Pakistan. South *Asian Journal of Operations and Logistics, 1*(1), 14-19. https://doi.org/10.57044/SAJOL.2022.1.1.2201

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics* (Vol. 5, pp. 481-498). Boston, MA: Pearson.

Tseng, S.M. and Lee, P.S., 2014. The effect of knowledge management capability and dynamic capability on organizational performance. *Journal of Enterprise Information Management*, *27*(2), 158-179. https://doi.org/10.1108/JEIM-05-2012-0025

Uyanık, L. O., Bilginaylar, K., & Etikan, İ. (2015). Effects of platelet-rich fibrin and piezosurgery on impacted mandibular third molar surgery outcomes. *Head & Face Medicine*, *11*(1), 1-7. https://doi.org/10.1186/s13005-015-0081-x

Victory, G. O., Lizzie, O. A. & Olaitan, A. A. (2022). Climate-Smart Agricultural Practices at Oyo State-Nigeria. *South Asian Journal of Social Review, 1*(1), 1-7. https://doi.org/10.57044/SAJSR.2022.1.1.2201

Yihdego, Y., Vaheddoost, B., & Al-Weshah, R. A. (2019). Drought indices and indicators revisited. *Arabian Journal of Geosciences, 12*(3), 1-12. https://doi.org/10.1007/s12517-019-4237-z

South Asian Journal of Social Review
2022 Vol. 1, No. 1, pp. 53-64
DOI: 10.57044/SAJSR.2022.1.1.2203

The Impact of Procurement Strategies on Supply Chain Sustainability in the Pharmaceutical Industry

Kahkshan Asif [1*]

*[*1]Independent Researcher, Karachi, Pakistan*

**Corresponding Author Email: kahkshan.asif@yahoo.com*

Article History

Received: 06 June 2022
Revised: 22 June 2022
Accepted: 26 June 2022
Published: 30 June 2022

JEL Classification:
Q21
R41
Q01
Q56

ABSTRACT

In today's society, procurement plays a significant role in sustainability because of the vital requirement and demand for improvement in some supply chain processes and procurement practices. It helps make rational decisions that encompass society's economic, social, and environmental parts. Corporate sustainability requires such abilities to impact external firms in the supply chain process. In the Economic advancement markers at worldwide, public and neighborhood levels advance sustainability approaches, as they represent the advancement in the supply chain process. This study used a quantitative research method followed by a convenient sampling technique for data collection from 102 respondents. This study found that procurement strategies significantly influence supply chain sustainability. The present study was conducted in the urban areas of Karachi, Pakistan. The study findings can benefit the manufacturing industry and society by implementing green purchasing and relevant, sustainable elements.

Keywords: *Green purchasing, Social factors, Economic factors, Environmental factors, Green supply chain management, Pakistan*

Citation of this article:

Asif, K. (2022). The Impact of Procurement Strategies on Supply Chain Sustainability in the Pharmaceutical Industry. *South Asian Journal of Social Review, 1*(1), 53-64. https://doi.org/10.57044/SAJSR.2022.1.1.2203

The Impact of Procurement Strategies on Supply Chain Sustainability in the Pharmaceutical Industry

1. Introduction

The pharmaceutical industry plays a significant role and is prime in the supply of life-saving medicines to this society. Pharmaceutical industries can influence the environment and impact society in many ways; patients improperly discard pills or tablets, expired and unutilized medicines, pesticides and molecular farming waste exclusion, pharmacies mishandling drugs, etc. (Hashmi et al., 2020). An ever-increasing request for items and their utilization has put weight on mechanical yield and their supply chains, resulting in adverse environmental and societal consequences. Increased levels of contamination and natural disasters produced by mechanical generating have prompted a few analysts and industry experts to focus on challenges related to maintainable generation and utilization within the context of Sustainable Supply Chain Management (Alam, 2022; Rasheed, 2022). The sustainable flow of goods Management has ended up with a theme of having extraordinary intrigued. It is connected to the suspicion that a more maintainable execution for businesses would be accomplished on its usage. Such execution has got to be accomplished in all three measurements of maintainability (Rashid et al., 2019; Rashid & Rasheed, 2022).

Further, sustainable growth is composing a plan of action incorporating various steps of human action that were a distinct feature previously, based on moral consideration concerning human responsibility for the environment. Sustainable supply chain complexity is a management conception that leads to far away performance of supply chain process. Putting efforts into environmentally and socially sustainable supply chain leads to benefits for current and the upcoming generations to a great extent, filling out the lucidity in the management of supply chain process into right-handed, economical, lawful, social and technical features of performance (Zimon et al., 2019; Hashmi & Mohd, 2020). Supply chain administration, which covers raw materials, finished goods, and data flow, has become a critical concern in advanced manufacturing and service frameworks. Supply chain management necessitates the effective use of resources and data that extends beyond the fulfilment of a client's request, a stream of goods and services. Within literature and most nonacademic assets, sustainability is defined as the ability to support a hone or prepare or as a reference to innate awareness. Both interpretations are substantial yet fragmented. Maintainability is directly linked to the idea of feasible improvement, characterized as "the innovation that satisfies the wants as in show without affecting the capacity of upcoming eras to suit their claim demands". The literature on sustainability of supply chains centres on audits conjointly many ideas to join supportability. Be that as it may, most of the existing literature considers as it were financial and natural perspectives of maintainability (Türkay et al., 2016). Environmental control of purchasing and the supply chain (specifically green purchasing) is now remarkably commonplace in the middle of larger companies and it shows that it is also increasingly used as a corporate practice. Participation in recycling initiatives demands close coordination with all the business partners, like an alliance with vendors to eliminate waste in raw and packaging (Hamner, 2006; Amjad, 2022).

Supplier management is a modified process that identifies that all the vendors are different from each other, and diversification is not required in customer-supplier partnerships with many different strategies. When this alternative is achieved, there is a great possibility to get better gain and value from both the offered services and the products procured. This can be achieved by the organization's involvement with the team and function in an organized way. Following the mass manufacturing model of managing business partners is not easy for all organizations. Many Organizations have distinct needs and varying supply networks against which they use to create supplier partner relationships better. Logistics management is also a part of the supply chain and plays a vital role in supply chain sustainability, implying the system is designed to move goods physically. Supply chain professionals describe the process of logistic management which is responsible for planning or designing,

implementing, and controlling efficient forward and reverse flows of goods, assistance, and any other alliance details between production and consumption. The main objective of logistics management is to meet customer requirements. In every firm, there are different logistics operations and different evaluation criteria (Amjad, 2022, Rasheed, 2022). Further, procurement has a vital role in sustainability as there is a demand for improvement in some policies and practices to enlarge firms' limitations in incorporating their whole frame of supply chain process. Proper Guidelines on sustainability inspire procurement to make rational decisions that encircle society's economic, environmental and social components. In corporate sustainability, procurement in handling the process is strenuous and requires excellent ability to impact external firms in the supply chain. Sustainability ways are being advised by various approaches that started economic advancement markers at worldwide, public and neighbourhood levels. These rules represent the expansiveness and intricacy of the subject (Meehan & Bryde, 2011; Anwar, 2022).

The Pharmaceutical flow of goods is mindful and accountable for impressive natural and product quality influence. Green chemistry may be a frame of recycling economy in the pharmaceutical flow of goods. Coordination of a supply chain that is moving forward is significant, including medications invert transportation (Viegas et al., 2019; Hashmi et al., 2020a). The long-running debate about drug industry costs, benefits, and development has resurfaced. In a few key ways, the pharmaceutical industry differs from other businesses. Since the 1930s, most high-intensity medications have only been available via prescription in the United States. In this regard, the purchaser and the utilization chief (the recommended doctor) are not the same. During the 1930s and 1940s, there was an uprising in medicine disclosure strategies, resulting in the introduction of over 1,200 new synthetic drugs into the United States, helpful practice since 1940. Few doctors can fully educate themselves about the available other possibilities because the drug menu is so vast and complex. Disappointments with data thrive.

Outside repayment arrangements developed by the government and private guarantors are expected to reimburse 44 per cent of physician-recommended prescription costs in 1987, up from 28 per cent in 1977. As a result, the physician-recommended medicine purchaser is frequently removed from the item dynamic and from following through on the whole cost associated with a decision. With these advancements has come a second shift in drug disclosure and improvement strategies. The essential logical investigation has begun to enlighten the compound instruments of disease, permitting R&D groups to plan-made medication particles with underlying features that communicate with target receptors in the human body in predictable ways. Genetic engineering has made it possible to clone freak creatures with desired therapeutic qualities and to replicate difficult-to-select human immunogens. Consequently, during the 1990s, the proportion of novel compounds appealing to regulatory approval skyrocketed. As a result, finding balance among monetary impetuses, rivalry, and restrictions has become even more critical (Scherer et al., 1993; Hunaid et al., 2022).

There is still much work to be done in developing a global supply chain sustainability metric. One of the essential takeaways from this research is the flow of building estimation may be even more essential than the actual measurement. For starters, the process requires — producers/manufacturers, vendors, governments, and end users to consider sustainability in the broader sense. Furthermore, this then highlights the importance of considering the complete flow of products instead of simply particular components. Decision-makers can concentrate narrowly on the most appealing and maybe convenient criteria or links. An athletic shoe manufacturer can minimize harmful ingredients while overlooking the sweatshop conditions in which the shoes are made. A big shop can concentrate on logistics and transportation. Cost reduction in the meantime neglecting the influence of consumption patterns on the environment made possible by discarded products. We can begin to make headway toward true sustainability allowing — or even forcing — managers to notice a problem's more significant standpoint (Sloan, 2010; Baloch & Rashid, 2022).

It is not, at this point, enough for firms to be concerned uniquely with looking for a benefit - they ought to likewise give something back to society everywhere, limit their adverse consequences on the climate and have some obligation regarding the conduct of their providers on issues, for example,

child labour, well-being and security and contamination. Supply chain management (SCM) is the administration of an organization of affiliated associations engaged with the arrangement of items and administrations to end clients (Walker & Jones, 2012; Shaheen, 2022). Effective commodities SCM process supports environmental sustainability as it dramatically impacts environmental changes. A supply chain can cause the emergence of greenhouse gas emissions, harmful and deadly gases, deforestation, etc. Thus, environmental sustainability set off the main body of the organizations (Hamner, 2006). Supplier management cannot be applied without a fundamental change in the procurement process. Moreover, innovations are needed to cooperate with all business partners in the supply chain network. The supplier and the customer should align together in close coordination. This occurs at the product or service level, which increases indulgence in an evaluation and the sourcing process in the supply chain framework (Alam, 2022). Therefore, this study will evaluate the effect of procurement strategies on supply chain sustainability.

> *RQ: Based on the research problem and objectives, this study will seek empirical answers to what extent the procurement strategies influence supply chain sustainability. That would provide a pathway to future strategies for supply chain sustainability.*

2. Literature Review

2.1 Procurement Management

Numerous creators concur that taking after components makes the provider choice-making system complex. The variables follow; (1) mixed and variety of criteria: both subjective & quantitative, (2) criteria conflict: clashing targets of scenarios, (3) Inclusion of the numerous choices: Since of increased level competition, and (4) inside & outside obliges about purchasing. In any case, it takes a parcel of work effort and persistence to create this organization. Since the correct provider choice preparation includes several roles like acquiring, within the company, quality, and so forth, several objectives may span many important and metaphysics variables in a very progressive way. A compelling provider means vendors that are capable supply the correct sum of items or administrations at the right time, at the right price, and with the right quality (Mwikali & Kavale, 2012). In the last two decades, the significance of procurement as a strategic concern for businesses was expanded. This is attributable to a number of causes, including rising purchasing costs, globalization, and a surge in outsourcing tactics. As a result, there seems to be a change in one-time transactions and the long-haul relationships that place a greater emphasis on suppliers as a primary source of revenue. Developing a tight relationship with suppliers allows gaining access to their resources, which can help expand organizational operations. This method also emphasizes that the purchaser must control the entire supply process, not just the flow of merchandise and services to the organization. Environmental & societal issues lead to the complexity of today's purchase decisions and processes.

According to this viewpoint, today's shoppers must consider factors other than the financial matrix when purchasing. Purchasers must also keep an eye on a brand new batch of hazards, like workers, safety, resource pollution and waste, as well as the possibility of a destructive impact on their company's image and the societal influence on purchasing actions. Because today's rivalry is centred on supply chains rather than organizations, the focus is on how to provide a reliable supply chain with plenty of redundancy, reliability, efficiency and response. Nobody can afford expenditures that exceed profit; this is attainable with real-time description and data at various supply chain nodes and accurate information transmission to the next level and speed (Modgil & Sharma, 2017). Through a web-based network of communications, information systems assist organizations in developing strategic partnerships with suppliers. The part of buying in supply administration has gotten and proceeds to get expanding consideration as the years go. On the other hand, many variables impact a company's decision-making ability. There should have to be a clear understanding of the provider determination criteria. A few factors firms consider incorporate belief and commitment, satisfactory back, quality, solid conveyance times, and satisfactory logistic technological capabilities (Mwikali & Kavale, 2012).

One more major way that organizations have strived to level up the growth and their company's

long-term viability is determined by involving environment-related issues and problems in their progressive issues of purchasing. Firms can, for example, collaborate with suppliers to discover raw materials with a lower environmental impact. Analysts measured the crucial features of environmentally friendly sourcing as well as the more practical aspects. In precise, there has been a tremendous amount of progress. Functioning point in terms of the environment, in addition, to a lower extent, social environment proportion of business line's long-term viability. Though, most of this study observed the single framework or businesses that are solely focused on one thing parameter distinctively. Tasks and Works investigating the incredible process of the supply chain context are essentially descriptive. In modern years, different organizations have started multiple attempts to 'green' their fields and businesses. The impulsion for these attempts is from the external factors. Like, producers of huge and bulk appliances must follow new rules regarding the recovery and maintenance of their products as they build the coming peer group of washers and dryers. Manufacturers have re-analyzed the unwanted or excess from their system to minimize the emissions, conserve energy, and find the best productive substitutes for breakdown products. Several organizations, citizens, and governments understand today there is a requirement and impact to move beyond green and have already started observing with a sense of growth and long-term viability. Generally, sustainable growth is clarifying in terms of economic activities that fulfil the requirements of the current situation without understanding the capacity of upcoming generations that encounter their requirements (Rashid et al., 2020; Hashmi et al., 2020).

Another primary side of the study links with the 'global' functions or performance estimation, which is how one evaluates the results of industries, countries and economies. Specific part encircles the progress of many combined parameters: mixed dimensions count the structure that finds the critical ideas and logic like human welfare, competition among industries, and the health care system's overall performance. During this time, several worthy learning can be derived that do not approach actual presentation measures as a result of this work from which team leads could utilize the improvement of sustainable supply chain flow. The motive of that research is to build the conceptual ground for the growth of the target to count the sustainability of the global supply chain. With the continuation of chasing the motive, the research paper creates three benefits. One, it explains the overview of the techniques and treatments recently utilized by companies for incorporating sustainability into business activities. Another is to launch a new workflow for consideration and to find out supply chain sustainability. The third one is to represent three studies' calculations that link to the worldwide parameters of the sustainability of the flow of supply chain process, which can be taken that results motivation and inspiration for the future conceptual and investigational studies from the research of Sloan (2010). Fast floating awareness in the industry that today's supply chains are defective or flawed. Up to the present, different companies, i.e., manufacturing, create waste and pollution and its fearsome for the existence of life on earth. Therefore, these pressures and challenges push organizations to seriously act on the impact on the environment during their business practices. As the majority in the world enlarges and the availability of resources reduces or minimizes, many firms or companies understand that the process of supply chains must also be re-designed in the current scenario. In the views of firms, they must picture the environmentally friendly view of the products, the processes, systems and technologies, and the process in which business is carried out.

Further, procurement refers to the act of locating, agreeing to terms, & obtaining items, services or tasks provided by a third party, most commonly by an offer and a cutthroat offer. When quality, quantity, time, and cost are taken into consideration, that interaction is used to ensure that the purchaser gets the best possible at the lowest possible cost for a product, service, or work. Financial limits on businesses and mass customization for clients add to the complexity, requiring businesses to use acquisition metrics as an effective tool for delivering results advantages within any cost of sourcing and operational cost. As a result, procurement is becoming increasingly paramount for chiefs & inventory network heads to figure out ways to make the most of digitalized procurement approaches to stay relevant in the organization (Gupta, 2019).

2.2 Supply Chain Sustainability

This section discusses the development of a quantitative measure of supply chain sustainability.

The purpose of this research is to develop a framework for a metric that captures the core of this inherently multi-dimensional and complex idea. However, it also poses a variety of measuring issues. There are five processes involved in the generation of composite indicators, according to the findings: 1. Create a conceptual framework, 2. determine & generate, 3. Standardize data, 4. Weight and categorization variables, and 5. conduct a sensitivity analysis. Almost all sectors have their own set of difficulties. The most difficult task is to create a conceptual framework. Several sustainability frameworks have been established, the majority of which are related to country performance. The linkage between supply chain quality, by and large, is characterized as the number and quality of the providers and clients in a nation, and the three measurements of feasible improvement to be specific natural execution, corporate natural hones, and social supportability is evaluated. The outcome demonstrates that supply chain quality is connected to all three measurements of maintainable improvement (Vachon & Mao, 2008; Rasheed, 2022). Environmental, societal, and economic considerations all play a role in sustainability. Some variables related to each dimension are listed below.

2.2.1 Environmental factors

The term "environment" is most commonly used to refer to the natural environment, which comprises all living and non-living items found in nature on earth, such as land, water, plants, and animals. Lowering the supply chain's ecological footprint is one way to improve environmental sustainability. Of the three areas of supply chain management, the environmental aspect has gotten the most attention. The environmental component plays a vital part in the arrangement of economic improvement of the regions (Glinskiy et al., 2016). In light of the complex issues included in sustainable advancement, we require more clear benchmarks for arranging and assessing our natural approaches. As a critical point, sustainability includes optimizing the intelligence between nature, society, and the economy, in agreement with biological criteria. Sustainable improvement looks to reconcile environmental security and improvement; it implies nothing more than utilizing assets no speedier than they can regenerate themselves and discharging poisons to no more prominent degree than average assets can acclimatize them (Merkel, 1998).

2.2.2 Social factors

In the current era of global, territorial, national and neighbourhood improvement in all spheres of the economy, different and conflicting changes take put, influencing all processes, including administration. In like manner, enterprises are effectively included in these processes, looking for drivers of improvement and competitiveness. Consequently, enhancing management approaches and apparatuses is a critical and vital condition for ensuring sustainable advancement. The urge to shape and actualize a viable administration framework is imperative for business. In this manner, uncommon consideration is paid to applying common standards and strategies of management and carrying out measures to guarantee the steady working of companies that try to reinforce their positions in a constantly changing environment. It is vital to utilize the accomplishments of world opinion, develop critical approaches and alter methodological approaches and the like (Drobyazko et al., 2019). Biological issues caused by human activities (economic) are declining and taking on worldwide dimensions. Climate alters, ozone-layer consumption, and misfortune of timberland cover are critical illustrations. At the same time, social conditions proceed to compound in numerous creating nations. Although budgetary and financial markets are becoming increasingly interconnected, and we like to think of a "worldwide town," our endeavours to cherish natural assurance and improvement as the common assignment and duty of all nations have started to create progress. On the off chance that we are to move toward sustainable advancement, the industrialized nations ought to acknowledge special responsibility--not as it were of their past ecological activities, but also because of their present technological know-how and budgetary assets. However, one must be beyond doubt that feasible generation and consumption involve technological advances and social designs of a person's behaviour and values (Merkel, 1998).

2.2.3 Economic factors

The economic dimension of the supply chain refers to the profit earned by supply chain members and the economic benefits obtained by host nations, regions, and communities of those members. Consequently, this dimension goes beyond a company's internal profit, and some of the traits within this category may be difficult to measure in terms of money. Economic considerations are classified into four groups. (1) performance of the economy: This alludes to a company's capability to conduct business and market value. (2) Financial health refers to the firm's overall well-being and long-term viability in terms of monetary resources (3) Market and organizational structure: This relates to the state of the market and the supply chain's configuration. (4) Entities /Processes: Refers to the internal and external processes, procedures, and values of the economic dimension (Sloan, 2010). Today, sustainability is attracting more attention at both the local and global levels, prompting issues about ways to make sustainability a priority in corporate strategy and operations. Sustainable construction flow can be a beneficial way for businesses to transition from being reactive in terms of pollution and waste reduction and other sustainable activities to being proactive in terms of taking full responsibility for their products, from raw material acquisition to ultimate disposal from a sustainability standpoint. This report investigates Malaysian manufacturing organizations' sustainable supply chain management methods. The paper's main contribution is to confirm the effects of SSCM methodologies on the firm's sustainable supply chain performance. Environmental purchasing and sustainable packaging have been found to directly impact a company's performance, particularly in terms of economic performance (Rasheed, 2022; Alam, 2022).

Companies face a problem in the marketplace when competing with other businesses. This predicament arose due to rising customer expectations and complicated supplier connections. Supply chain management (SCM) has grown in importance and is a crucial problem for most firms due to intense competition (Ali, 2022). Supply chain management aims to improve an organization's operational efficiency (Hashmi et al., 2020b). The supply chain is also beneficial in operational cost-efficiency. This will automatically make a significant contribution to the organization's overall success. The function of information systems (IS) in catalyzing the phases in the entire supply chain becomes critical. Information systems enabled by advanced technology aim to speed up corporate processes by providing reliable data and quick access to data from one system to the next. Cost-effectiveness can be accomplished by having a well-functioning supply chain. In SCM research, time and speed are valued, carrying the motive of achieving speedy delivery at its most basic potential price. SCM requires flexibility to respond to market/customer needs and speed to market. Many authors have concentrated on an organization's financial performance, which is crucial; however, non-financial measurements are frequently utilized to address strategic challenges and day-to-day operations. The pharmaceutical sector plays a vital role in the economy and individuals' lives. Pharmaceuticals and their formulations are two types of pharmaceutical goods that are developed. Pharmaceutical items (drugs) begin their journey from raw ingredients to the end user via the producer. As a result, in terms of value creation, a manufacturing plant is critical to the supply chain (Victory et al., 2022). In the pharmaceutical industry, operational effectiveness impacts product quality, cost, delivery, and flexibility. Based on the research problem and relevant literature, the research model is given in Figure 1.

Figure 1: Research model

3. Research Methodology

The quantitative method was followed to test the research hypothesis. Whereas both inductive and deductive procedures can be used when dealing with mixed data of examination utilized (Rashid &

Amirah, 2017). Quantitative exploration encompasses the process of acquiring and analyzing data in an objective manner (Hashmi et al., 2021). Quantitative research means broadening in several environments; there are norms of behaviour and phenomena. Further, exploration is used to put a notion to the test and then either support or reject it. Besides, quantitative information requires factual or statistical examination to test theories (Rashid et al., 2021). A deductive method is used because it allows the research to deduce from non-specific. Moreover, the analyst constructs a hypothetical system based on common viewpoints and arrives at a specific conclusion. The deductive method of investigation or thinking comprises an investigation of theories, improvement of hypothetical systems or hypotheses, statistical testing hypothesis, and affirmation of a particular conclusion drawn coherently from premises (Rashid et al., 2021).

Further, sampling is a method (strategy or tool) used by an analyst to pick a relatively fewer quantity of delegated objects deliberately and people (a subset) of a predetermined population act as participants (information hotspot to perceive or experiment based on the investigation's goals (Agha et al., 2021; Alrazehi et al., 2021; Das et al., 2021; Haque et al., 2021; Khan et al., 2021; Rashid et al., 2021; Modgil & Sharma, 2017). Questionnaires and surveys were designed to collect data from 102 respondents from various organizations that is greater than 100 and is adequate to generalize the findings of this research (Rashid, 2016; Khan et al., 2022). The present study was conducted in the urban areas of Karachi, Pakistan, by a survey questionnaire (Rashid et al., 2021; Khan et al., 2022; Khan et al., 2022).

4. Data Analysis

The demographic profiles of respondents were analyzed to identify the various trends and found males 52% and females 50%. The respondents were 56.9% from the 25– 30 age group, 34.3 % between 30 and 35 and 8.8% between 40 – 45. The reliability test was carried out to verify model uniformity using SPSS software version 22. The results found a 0.845 Cronbach's Alpha value greater than 0.70 (Hashmi et al., 2021). The model summary expressed an R^2 of 45.2%. This means that 45 % of the time, the response variable is estimated correctly by independent variables. The ANOVA test for Analysis of Variance, where the significance value of 0.000 < 0.05 with *an F* statistics value of 84.226, suggested that the model is statistically significant. Besides, the coefficients results suggested the standardized beta coefficient value of 0.676 (significant value 0.000 < 0.05), which means a unit change in procurement strategies significantly impacts the supply chain sustainability. Hence procurement strategies are significantly adding anything to the prediction, and hypothesis *H1* is supported.

5. Discussion

The study's hypothesis shows that procurement strategies significantly impact the viability of supply chain sustainability. This hypothesis was accepted as value .000 in the co-efficient results by implementing sustainability in our procurement process and raw material sourcing. It reduces the emission of harmful gases and soil, water and air pollution. Operational effectiveness significantly affects the material's quality and environmental health. Cost reduction benefits and increased productivity can be found. It also improves energy efficiency. Environmental control of purchasing and the supply chain (specifically green purchasing) is now remarkably commonplace in the middle of larger companies, and it shows that it is also increasingly used as a corporate practice. Participation in recycling initiatives demands close coordination with all the business partners, like an alliance with vendors to eliminate waste in raw and packaging. To build evaluation criteria with vendors, use of grading system for suppliers on their performance, design questionnaire for supplier evaluation, to set the standard of environmental process in the selection of strategic business partner, evaluation criteria should also apply in the buying process (Hamner, 2006).

The study's leading element is to analyze the influence of different procurement strategies and techniques on the long-term viability of the supply chain process. Today, sustainability is captivating more consciousness at local and global levels, pushing concern about ways to incorporate sustainability into corporate strategy and operations. Operational effectiveness has a consequence on the quality of

results, cost, delivery, and adaptability in the pharmaceutical industry. The management of the supply chain has evolved into a matter of contention due to ruthlessness. The motive of a chain of supplies management is to enhance an organization's operational efficiency. The chain of supplies further assists in the operational convenience and frugal. The OP would impulsively make a remarkable contribution to the organization's overall performance (Hashmi et al., 2021). Environmental, societal, and economic reflection all play a role in sustainability.

5.1 Conclusion

This study has some limitations, like other research studies. It has a time limitation as it was completed in a short period. Second, the study was self-contained and with no additional funds engaged in the research work. We have specifically targeted the manufacturing industry of Karachi. It has a geographical constraint, and the research was conducted only in one city, i.e., Karachi, Pakistan. The research was conducted on procurement strategies and supply chain sustainability. Future research may be conducted by using different variables. This can be done in different regions of Pakistan and outside Pakistan. Different areas of the supply chain process for sustainability impact can be focused on highlighting other significant issues for improvement and enhancing research possibilities for further learning and awareness as there is still much work to be done in developing global supply chain sustainability. Future research can also be characterized as efficient thinking about conceivable future occasions and circumstances. It is distinctive from determining in that the previous includes a forward orientation, looks ahead, or maybe reverse, and is not as numerical as estimating. There is a vast extent of strategies accessible that can be utilized to conduct prospect considers. The nature of decision-making utilizing the output of prospects ponders can be drawn closer from four elective points of view, i.e. (1). Values point of view categorizes forecasted results of occasions and events as great or terrible. Appropriately, the esteem viewpoint tends to be exceedingly subjective due to esteem differences among individuals. (2). Rational viewpoint relates to determining an elective among choice choices guided by the degree to which each elective meets specific criteria. (3). Judgment heuristics is related to a propensity towards hazard taking and depending on instinct when locked in choice making. (4). Cognitive science's point of view on choice making depends on the inductive handle of thought and taking choices due to the inductive examination by people and related computer programs. Lastly, future research might use different approaches to investigate biases in standard methods. As the majority in the world enlarges and the availability of resources reduces or minimizes, many firms or companies understand that the process of supply chains must also be re-designed in the current scenario.

References

Agha, A. A., Rashid, A., Rasheed, R., Khan, S., & Khan, U. (2021). Antecedents of Customer Loyalty at Telecomm Sector. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 1352-1374.

Alam, M. (2022). Supply Chain Management Practices and Organizational Performance in Manufacturing Industry. *South Asian Journal of Social Review, 1*(1), 42-52. https://doi.org/10.57044/SAJSR.2022.1.1.2204

Ali, S. B. (2022). Industrial Revolution 4.0 and Supply Chain Digitization. *South Asian Journal of Social Review, 1*(1), 21-41. https://doi.org/10.57044/SAJSR.2022.1.1.2205

Alrazehi, H. A. A. W., Amirah, N. A., Emam, A. S., & Hashmi, A. R. (2021). Proposed model for entrepreneurship, organizational culture and job satisfaction towards organizational performance in International Bank of Yemen. *International Journal of Management and Human Science, 5*(1), 1-9.

Amjad, S. (2022). Role of Logistical Practices in Quality Service Delivery at Supermarkets: A Case Study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 39-56. https://doi.org/10.57044/SAJOL.2022.1.1.2204

Anwar, M. F. A. (2022). The Influence of Inter-Organizational System Use and Supply Chain Capabilities on Supply Chain Performance. *South Asian Journal of Operations and Logistics, 1*(1), 20-38. https://doi.org/10.57044/SAJOL.2022.1.1.2203

Baloch, N. & Rashid, A. (2022). Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis. *South Asian Journal of Operations and Logistics, 1*(1), 1-13. https://doi.org/10.57044/SAJOL.2022.1.1.2202

Das, S., Ghani, M., Rashid, A., Rasheed, R., Manthar, S., & Ahmed, S. (2021). How customer satisfaction and loyalty can be affected by employee's perceived emotional competence: The mediating role of rapport. *International Journal of Management, 12*(3), 1268-1277. DOI: 10.34218/IJM.12.3.2021.119.

Drobyazko, S., Okulich-Kazarin, V., Rogovyi, A., Goltvenko, O., & Marova, S. (2019). Factors of influence on the sustainable development in the strategy management of corporations. *Academy of Strategic Management Journal, 18*, 1-5.

Glinskiy, V., Serga, L., & Khvan, M. (2016). Assessment of environmental parameters impact on the level of sustainable development of territories. *Procedia CIRP, 40*, 625-630. https://doi.org/10.1016/j.procir.2016.01.145

Gupta, V. (2019). Procurement strategies for digital supply chains: Concepts and best practices. In Technology optimization and change management for successful digital supply chains (pp. 17-38). IGI Global. https://doi.org/10.4018/978-1-5225-7700-3.ch002

Hamner, B. (2006). Effects of green purchasing strategies on supplier behaviour. In *Greening the supply chain* (pp. 25-37). Springer, London. https://doi.org/10.1007/1-84628-299-3_2

Haque, I., Rashid, A., & Ahmed, S. Z. (2021). The Role of Automobile Sector in Global Business: Case of Pakistan. *Pakistan Journal of International Affairs. 4*(2), 363-383. https://doi.org/10.52337/pjia.v4i2.195

Hashmi, A. R., & Mohd, A. T. (2020). The effect of disruptive factors on inventory control as a mediator and organizational performance in Health Department of Punjab, Pakistan. *International Journal of Sustainable Development & World Policy, 9*(2), 122-134. https://doi.org/10.18488/journal.26.2020.92.122.134

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020a). Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan. *Management Science Letters, 11*(1), 77-86. https://doi.org/10.5267/j.msl.2020.8.028

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020b). Mediating effect of integrated systems on the relationship between supply chain management practices and public healthcare performance: Structural Equation Modeling. *International Journal of Management and Sustainability, 9*(3), 148-160. https://doi.org/10.18488/journal.11.2020.93.148.160

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2020). Exploring the dimensions using exploratory factor analysis of disruptive factors and inventory control. *The Economics and Finance Letters, 7*(2), 247-254. https://doi.org/10.18488/journal.29.2020.72.247.254

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021). Mediation of inventory control practices in proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management, 9*(1), 89-98. https://doi.org/10.5267/j.uscm.2020.11.006

Hunaid, M., Bhurgri, A. A., & Shaikh, A. (2022). Supply Chain Visibility in Leading Organizations of the Shipping Industry. *South Asian Journal of Social Review, 1*(1), 8-20. https://doi.org/10.57044/SAJSR.2022.1.1.2202

Khan, S. K., Ahmed, S., & Rashid, A. (2021). Influence of social media on purchase intention and customer loyalty of generation Y with the mediating effect of conviction: a case of Pakistan. *Pakistan Journal of International Affairs. 4*(2), 526-548. https://doi.org/10.52337/pjia.v4i2.207

Khan, S., Benhamed, A., Rashid, A., Rasheed, R., & Huma, Z. (2022). Effect of leadership styles on employees' performance by considering psychological capital as mediator: evidence from airlines industry in emerging economy. *World Journal of Entrepreneurship, Management and Sustainable Development, 18*(8). https://wasdlibrary.org/publications/journals/wjemsd/

Khan, S., Rasheed., R., & Rashid, A., Abbas, Q., & Mahboob, F. (2022). The Effect of Demographic Characteristics on Job Performance: An Empirical Study from Pakistan. *Journal of Asian Finance, Economics and Business, 9*(2), 283-294. https://doi.org/10.13106/jafeb.2022.vol9.no2.0283

Khan, S., Rashid, A., Rasheed, R., & Amirah, N. A. (2022). Designing a knowledge-based system (KBS) to study consumer purchase intention: the impact of digital influencers in Pakistan. *Kybernetes, 51*(1). https://doi.org/10.1108/K-06-2021-0497

Meehan, J., & Bryde, D. (2011). Sustainable procurement practice. *Business Strategy and the Environment, 20*(2), 94-106. https://doi.org/10.1002/bse.678

Merkel, A. (1998). The role of science in sustainable development. *Science, 281*(5375), 336-337. https://doi.org/10.1126/science.281.5375.336

Modgil, S., & Sharma, S. (2017). Information systems, supply chain management and operational performance: tri-linkage-an exploratory study on pharmaceutical industry of India. *Global Business Review, 18*(3), 652-677. https://doi.org/10.1177/0972150917692177

Mwikali, R., & Kavale, S. (2012). Factors affecting the selection of optimal suppliers in procurement management. *International Journal of Humanities and Social Science, 2*(14), 189-193.

Rasheed, T. (2022). Supply Chain Sustainability Through Green Practices in Manufacturing: A Case Study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 57-71. https://doi.org/10.57044/SAJOL.2022.1.1.2205

Rashid, A. & Rasheed, R. (2022). A Paradigm for Measuring Sustainable Performance Through Big Data Analytics-Artificial Intelligence in Manufacturing Firms. Available at SSRN 4087758. https://doi.org/10.2139/ssrn.4087758

Rashid, A. (2016). Impact of inventory management in downstream chains on customer satisfaction at manufacturing firms. *International Journal of Management, IT and Engineering, 6*(6), 1-19.

Rashid, A., & Amirah, N. A. (2017). Relationship between poor documentation and efficient inventory control at Provincial Ministry of Health, Lahore. *American Journal of Innovative Research and Applied Sciences, 5*(6), 420-423.

Rashid, A., Amirah, N. A., & Yusof, Y. (2019). Statistical approach in exploring factors of documentation process and hospital performance: a preliminary study. *American Journal of Innovative Research and Applied Sciences, 9*(4), 306-310.

Rashid, A., Amirah, N. A., Yusof, Y., & Mohd, A. T. (2020). Analysis of demographic factors on perceptions of inventory managers towards healthcare performance. *The Economics and Finance Letters, 7*(2), 289-294. https://doi.org/10.18488/journal.29.2020.72.289.294

Rashid, A., Rasheed, R., Amirah, N. A., Yusof, Y., Khan, S., & Agha, A., A. (2021). A Quantitative Perspective of Systematic Research: Easy and Step-by-Step Initial Guidelines. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 2874-2883.

Scherer, F. M. (1993). Pricing, profits, and technological progress in the pharmaceutical industry. *Journal of Economic Perspectives, 7*(3), 97-115. https://doi.org/10.1257/jep.7.3.97

Shaheen, S. (2022). Quality management and operational performance: a case study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 14-19. https://doi.org/10.57044/SAJOL.2022.1.1.2201

Sloan, T. W. (2010). Measuring the sustainability of global supply chains: Current practices and future directions. *Journal of Global Business Management, 6*(1), 1-16.

Türkay, M., Saraçoğlu, Ö., & Arslan, M. C. (2016). Sustainability in supply chain management: Aggregate planning from sustainability perspective. *PloS one, 11*(1), e0147502. https://doi.org/10.1371/journal.pone.0147502

Vachon, S., & Mao, Z. (2008). Linking supply chain strength to sustainable development: a country-level analysis. *Journal of Cleaner Production, 16*(15), 1552-1560. https://doi.org/10.1016/j.jclepro.2008.04.012

Victory, G. O., Lizzie, O. A. & Olaitan, A. A. (2022). Climate-Smart Agricultural Practices at Oyo State-Nigeria. *South Asian Journal of Social Review, 1*(1), 1-7. https://doi.org/10.57044/SAJSR.2022.1.1.2201

Viegas, C. V., Bond, A., Vaz, C. R., & Bertolo, R. J. (2019). Reverse flows within the pharmaceutical supply chain: A classificatory review from the perspective of end-of-use and end-of-life medicines. *Journal of Cleaner Production, 238*, 117719. https://doi.org/10.1016/j.jclepro.2019.117719

Walker, H., & Jones, N. (2012). Sustainable supply chain management across the UK private sector. *Supply Chain Management: An International Journal, 17*(1), 15-28. https://doi.org/10.1108/13598541211212177

Zimon, D., Tyan, J., & Sroufe, R. (2019). Implementing sustainable supply chain management: Reactive, cooperative, and dynamic models. *Sustainability, 11*(24), 7227. https://doi.org/10.3390/su11247227