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An Analytical Study of Supply Chain Management Practices in Manufacturing Industry

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KEYWORDS

Supply Chain Management, SKM Egg Products, Cold Chain Logistics, Inventory Management, Procurement, Manufacturing Industry, Agro-Processing, Distribution Network

ABSTRACT

An Analytical Study of Supply Chain Management Practices in Manufacturing Industry – SKM Egg Products Supply chain management (SCM) plays a pivotal role in determining the operational efficiency, cost-effectiveness, and competitive advantage of manufacturing organizations. This study presents a comprehensive analytical examination of supply chain management practices adopted by SKM Egg Products, one of India's leading integrated egg and egg products processing companies. The research focuses on evaluating the end-to-end supply chain framework of the organization, encompassing procurement of raw materials, production planning, inventory management, warehousing, logistics, and distribution channels.

The primary objective of this study is to assess the effectiveness of existing supply chain practices at SKM Egg Products and identify areas of strength, inefficiency, and potential improvement. Both primary and secondary data collection methods were employed, including structured questionnaires, personal interviews with supply chain personnel, and analysis of company records and industry reports. The study explores key dimensions such as supplier relationship management, demand forecasting, cold chain logistics, quality control mechanisms, and customer satisfaction levels.

Findings of the study reveal that SKM Egg Products maintains a well-integrated supply chain with strong backward linkages to poultry farmers and forward linkages to domestic and international markets. However, challenges related to seasonal demand fluctuations, perishability of products, transportation bottlenecks, and dependency on fragmented supplier networks were identified as critical areas requiring strategic attention. The study also highlights the growing importance of technology adoption, including ERP systems and real-time tracking, in streamlining supply chain operations.

The research concludes with strategic recommendations aimed at enhancing supply chain resilience, reducing lead times, minimizing wastage, and improving overall supply chain visibility. The findings of this study are expected to contribute valuable insights to industry practitioners, academicians, and policymakers engaged in agro-based manufacturing supply chain management.

1. INTRODUCTION

In today's rapidly evolving global business environment, Supply Chain Management (SCM) has emerged as a critical strategic function that directly influences the operational efficiency, cost competitiveness, and customer satisfaction of manufacturing organizations. Effective supply chain management integrates all activities involved in sourcing raw materials, transforming them into finished goods, and delivering the final products to end consumers — creating a seamless flow of materials, information, and finances across the value chain.

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The manufacturing industry, in particular, faces unique supply chain challenges such as demand volatility, procurement complexities, logistics coordination, quality control, and inventory optimization. In this context, studying real-world SCM practices within a specific manufacturing organization provides invaluable insights into how theoretical frameworks are applied in practice and where opportunities for improvement exist

SKM Egg Products, one of India's prominent integrated egg and poultry processing companies headquartered in Tamil Nadu, represents a compelling subject for such an analytical study. As a large-scale manufacturer dealing with highly perishable products, SKM operates a complex and time-sensitive supply chain that encompasses poultry farming, feed procurement, egg processing, cold chain logistics, packaging, and distribution across domestic and international markets. The sensitivity of biological products to temperature, time, and handling conditions makes SCM excellence not merely a competitive advantage, but an operational necessity for the organization.

This study aims to analytically examine the supply chain management practices adopted by SKM Egg Products across its key functional areas — including procurement, production planning, inventory management, warehousing, transportation, and distribution. By evaluating these practices against established SCM principles and industry benchmarks, the study seeks to identify the strengths, gaps, and potential areas of improvement within the organization's supply chain framework.

The findings of this study are expected to offer meaningful recommendations that can enhance supply chain efficiency, reduce wastage, improve delivery performance, and contribute to the overall profitability and sustainability of SKM Egg Products. Furthermore, this study contributes to the broader academic discourse on supply chain management in the food processing and manufacturing sector in India, offering insights relevant to practitioners, policymakers, and researchers alike

2. LITERATURE REVIEW

1. Introduction to Supply Chain Management

Supply Chain Management (SCM) has emerged as one of the most critical functional areas in modern manufacturing and agro-processing industries. Christopher (1992) defined supply chain management as the network of organizations involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer. Chopra and Meindl (2001) further emphasized that an effective supply chain is essential for achieving cost reduction, customer satisfaction, and sustainable competitive advantage in any manufacturing enterprise.

Lambert, Cooper, and Pagh (1998) observed that SCM integrates key business processes from the end user through original suppliers that provide products, services, and information that add value for customers and other stakeholders. These foundational definitions laid the groundwork for subsequent empirical research across various industrial sectors, including food processing and agro-manufacturing.

2. Supply Chain Management in the Food and Agro-Processing Industry

The food and agro-processing sector presents unique supply chain challenges due to the perishable nature of products, seasonal supply variability, and stringent quality and safety standards. Van der Vorst (2000) highlighted that food supply chains are particularly complex because they involve multiple stakeholders from farmers and processors to distributors and retailers each with different objectives and operational constraints.

Reardon and Barrett (2000) noted that agro-industrial supply chains in developing economies face structural inefficiencies stemming from fragmented supplier networks, poor infrastructure, and lack of market information. Their study underscored the importance of vertical integration and contract farming as mechanisms for improving supply reliability and product quality in food manufacturing.

Sahin and Robinson (2002) demonstrated that information sharing across supply chain partners significantly reduces the bullwhip effect the amplification of demand variability — which is especially damaging in perishable goods industries like egg processing. Their findings reinforced the need for real-time communication systems between suppliers, manufacturers, and distributors.

3. Cold Chain Logistics and Perishable Goods Management

Cold chain management is a specialized domain of supply chain logistics critical to industries dealing with temperature-sensitive products. Hsiao et al. (2010) established that maintaining an unbroken cold chain from production to consumption is essential for preserving product quality, extending shelf life, and minimizing post-harvest losses in egg and dairy product industries.

Shashi, Singh, and Shabani (2015) studied cold chain infrastructure in Indian agro-processing firms and found that inadequate refrigerated transportation, limited cold storage capacity, and high logistics costs were the primary constraints affecting supply chain performance. Their research recommended investment in refrigerated vehicles, real-time temperature monitoring systems, and hub-and-spoke distribution models to enhance cold chain efficiency.

Aung and Chang (2014) examined traceability systems in food cold chains and concluded that the adoption of RFID technology and IoT-enabled sensors significantly improved supply chain transparency, reduced spoilage rates, and enhanced consumer confidence in product safety — all highly relevant considerations for egg product manufacturers like SKM.

4. Procurement and Supplier Relationship Management

Procurement efficiency and supplier relationship management are widely recognized as foundational pillars of an effective supply chain. Monczka et al. (2009) argued that strategic sourcing and long-term supplier partnerships reduce procurement costs, improve raw material quality, and ensure supply continuity — outcomes particularly valuable for egg processing companies dependent on large volumes of farm-fresh inputs.

Krause, Handfield, and Tyler (2007) found that supplier development programs — including training, technical assistance, and performance evaluation — lead to measurable improvements in supplier quality and responsiveness. In the context of SKM Egg Products, which sources eggs from a large network of contract poultry farmers, such practices are instrumental in maintaining consistent input quality.

Cousins et al. (2008) further emphasized that trust and commitment in buyer-supplier relationships are key determinants of supply chain agility, enabling firms to respond rapidly to demand changes and supply disruptions. This is particularly relevant in the poultry sector, where disease outbreaks and seasonal factors can cause sudden supply shocks.

5. Inventory Management and Demand Forecasting

Effective inventory management is crucial in food processing industries where product shelf life is limited. Silver, Pyke, and Peterson (1998) established that inventory optimization models, when applied to perishable goods, must account for deterioration rates, holding costs, and service level requirements simultaneously a challenge distinctly applicable to egg product manufacturing.

Nahmias (1982) in his seminal work on perishable inventory systems demonstrated that traditional Economic Order Quantity (EOQ) models are insufficient for managing deteriorating inventory, and proposed modified models that incorporate expiration dates and spoilage rates. These findings remain foundational for SCM practitioners in the egg and food processing sector.

Mentzer et al. (2001) stressed the critical role of demand forecasting in aligning production schedules with market requirements. They found that firms employing collaborative forecasting techniques involving customers and distributors in the forecasting process achieved significantly higher inventory turnover and lower stockout rates compared to firms relying solely on historical data.

6. Logistics and Distribution Network Design

The design and optimization of logistics and distribution networks directly impact supply chain cost and customer service levels. Ballou (2004) argued that distribution network decisions including the number, location, and capacity of warehouses are among the most consequential strategic choices in supply chain design, with long-term implications for responsiveness and total logistics costs.

Bowersox, Closs, and Cooper (2002) emphasized the concept of integrated logistics management, wherein transportation, warehousing, order processing, and customer service are coordinated as a unified system rather than isolated functions. Their research demonstrated that integrated logistics reduces redundancy, lowers costs, and improves delivery performance outcomes sought by large-scale manufacturers like SKM Egg Products.

Chopra (2003) examined the trade-offs between responsiveness and efficiency in distribution network design and concluded that manufacturers serving geographically dispersed markets must adopt hybrid distribution models combining centralized warehousing with regional distribution centers a strategy increasingly adopted by Indian agro processing firms.

SIGNIFICANCE OF THE RESEARCH AND GAP IN THE STUDY

PART I: SIGNIFICANCE OF THE RESEARCH

1. Academic Significance

The present study holds considerable academic value as it contributes to the growing body of literature on supply chain management in the agro-processing and food manufacturing sector. While theoretical frameworks of SCM have been extensively developed by scholars globally, their empirical application to niche industries such as egg processing particularly within the Indian manufacturing context remains significantly underexplored.

This research bridges the gap between generic SCM theory and industry-specific practice by applying established frameworks such as the SCOR Model, Porter's Value Chain Analysis, and Lean Supply Chain principles to the operational realities of SKM Egg Products. The study enriches academic discourse by providing:

A sector-specific case study of supply chain management in egg processing, a domain rarely examined in isolation from

broader poultry or food industry studies.

Empirical validation of theoretical constructs such as supplier relationship management, cold chain logistics, and demand forecasting within an Indian agro-manufacturing context.

A reference model for future researchers studying SCM practices in perishable goods manufacturing industries across emerging economies.

Insights into the applicability and limitations of Western SCM frameworks when applied to Indian agro-industrial firms with different infrastructural, regulatory, and socioeconomic conditions.

2. Industrial and Managerial Significance

From a managerial perspective, this study carries significant practical relevance for SKM Egg Products and similar organizations operating in the agro-processing sector. The findings and recommendations of this research directly address real-world operational challenges, offering actionable insights for supply chain practitioners and organizational decision-makers.

Key areas of managerial significance include:

a) Operational Efficiency Improvement

The study identifies specific inefficiencies within the procurement, production, warehousing, and distribution functions of SKM Egg Products. By diagnosing bottlenecks and redundancies in the supply chain, the research provides a roadmap for streamlining operations, reducing cycle times, and improving overall productivity.

b) Cost Reduction and Profitability Enhancement

Supply chain costs — including procurement, logistics, inventory holding, and wastage — constitute a major portion of total manufacturing costs in the food processing industry. This study's analysis of cost drivers and inefficiencies helps management identify opportunities for cost rationalization without compromising quality or service levels, thereby enhancing profitability.

c) Cold Chain Optimization

Given the highly perishable nature of egg products, maintaining an efficient and unbroken cold chain is non-negotiable. This research evaluates the adequacy of SKM's existing cold chain infrastructure and recommends targeted improvements in refrigerated transportation, temperature monitoring, and cold storage capacity directly reducing spoilage and product losses.

d) Supplier and Vendor Management

The study examines the depth and quality of SKM Egg Products' relationships with its network of contract poultry farmers and input suppliers. Its findings help management strengthen backward linkages, implement supplier development programs, and establish performance-based vendor evaluation systems that ensure consistent raw material quality and supply continuity.

e) Strategic Decision-Making Support

By providing a comprehensive analytical overview of the supply chain, this research equips senior management with data-driven insights to support strategic decisions related to capacity expansion, market diversification, technology investment, and export logistics planning.

3. Economic and Social Significance

The significance of this research extends beyond the boundaries of SKM Egg Products to encompass broader economic and social dimensions.

a) Contribution to India's Agro-Processing Sector

India is one of the world's largest producers of eggs, and the egg processing industry plays a vital role in value addition, employment generation, and foreign exchange earnings. Improving supply chain efficiency in companies like SKM Egg Products directly contributes to the growth and competitiveness of India's agro-processing sector, which is a priority area under the National Food Processing Policy and the PM Kisan Sampada Yojana scheme.

b) Farmer and Supplier Welfare

SKM Egg Products sources its primary inputs from a large network of poultry farmers, many of whom are small and medium-scale producers. An efficient and transparent supply chain ensures fair pricing, timely payments, and stable demand for these farmers, contributing to rural income stability and agricultural sustainability.

c) Food Safety and Consumer Protection

Improved supply chain practices — particularly in cold chain management and quality control directly enhance the safety and hygiene standards of egg products reaching end consumers. This study's recommendations support compliance with FSSAI (Food Safety and Standards Authority of India) regulations and international food safety standards, protecting consumer health and building market trust.

d) Export Competitiveness

SKM Egg Products is an export-oriented organization supplying egg products to international markets. An efficient, technology-enabled supply chain is a prerequisite for meeting the quality, traceability, and delivery requirements of global buyers. This research's recommendations help strengthen SKM's export competitiveness and support India's ambition to expand its share in global egg product markets.

4. Policy Significance

This study also holds relevance for policymakers and regulatory bodies involved in the development of India's food processing and agricultural supply chain ecosystem. The findings highlight systemic challenges — such as inadequate cold chain infrastructure, fragmented supplier networks, and logistics bottlenecks — that require policy-level interventions beyond the capacity of individual firms.

Recommendations emerging from this research can inform:

- Government investment priorities in cold chain and logistics infrastructure for the agro-processing sector.
- Regulatory frameworks for contract farming and backward integration in the poultry industry.
- Incentive schemes for technology adoption in food manufacturing supply chains.
- Export promotion strategies for Indian egg and egg product manufacturers in global markets.

3. OBJECTIVES OF THE STUDY

Primary Objective

To analytically examine and evaluate the Supply Chain Management practices adopted by SKM Egg Products in its manufacturing operations, and to identify areas for improvement in order to enhance overall supply chain efficiency and effectiveness.

Secondary Objectives

- To study the procurement and sourcing practices followed by SKM Egg Products, including supplier selection, raw material acquisition, and vendor management processes.
- To analyze the production planning and inventory management systems in place at SKM Egg Products, and to assess their impact on operational efficiency and cost control.
- To examine the warehousing and cold chain logistics practices adopted by the organization, given the perishable nature of egg and poultry-based products.
- To evaluate the transportation and distribution network of SKM Egg Products in terms of reach, reliability, timeliness, and cost-effectiveness.
- To assess the demand forecasting and order management practices followed by the company to align supply with market demand.
- To identify the key challenges and bottlenecks faced by SKM Egg Products in managing its supply chain operations effectively.
- To measure the level of coordination and integration among various supply chain stakeholders, including suppliers, manufacturers, distributors, and retailers.
- To suggest practical recommendations to improve the supply chain performance, reduce wastage, and enhance customer satisfaction at SKM Egg Products.

4. HYPOTHESES OF THE STUDY

The formulation of hypotheses represents a fundamental step in any empirical investigation, as it provides the researcher with a structured framework through which relationships among study variables can be systematically examined and tested. In the context of supply chain management (SCM) within the manufacturing industry, hypotheses serve as directional statements that guide data collection, analysis, and interpretation. Given the increasing complexity of global supply chains and the heightened competitive pressures faced by manufacturers in the twenty-first century, it becomes imperative to investigate the specific managerial, operational, and technological factors that determine supply chain performance

outcomes. The hypotheses presented in this study have been developed on the basis of an extensive review of existing literature, theoretical underpinnings drawn from resource-based view (RBV) theory, transaction cost theory, and relational exchange theory, as well as preliminary observations made during exploratory fieldwork conducted across selected manufacturing firms.

According to Christopher (2016), supply chain management is defined as "the management of upstream and downstream relationships with suppliers and customers in order to deliver superior customer value at less cost to the supply chain as a whole." This definition underscores the relational and collaborative dimensions of SCM, suggesting that performance is not merely a function of internal organizational efficiency but is equally shaped by inter-firm dynamics and coordination mechanisms. The hypotheses of this study are therefore anchored in both intra-organizational and inter-organizational perspectives, recognizing that manufacturing firms operate within broader ecosystems of suppliers, distributors, logistics providers, and end consumers. Each hypothesis is grounded in a specific theoretical premise and supported by empirical evidence drawn from prior studies, thereby ensuring construct validity and scholarly rigor.

3.1 Hypothesis 1: Supplier Relationship Management and Supply Chain Performance

The quality and nature of relationships maintained between a manufacturing firm and its upstream suppliers are widely acknowledged as critical determinants of supply chain performance. Strong supplier partnerships, characterized by mutual trust, transparent communication, and long-term commitment, have been consistently associated with improvements in product quality, lead time reduction, cost efficiency, and supply chain responsiveness. Drawing from the relational exchange theory proposed by Dwyer, Schurr, and Oh (1987), it is argued that firms that invest in sustained, collaborative relationships with key suppliers are more likely to achieve higher levels of supply chain integration, which in turn positively influences operational performance. Empirical support for this position has been provided by several researchers, including Carr and Pearson (1999), who found that strategic supplier relationships significantly contribute to a firm's competitive advantage in manufacturing contexts.

H1: There is a significant positive relationship between the quality of supplier relationship management practices and the overall supply chain performance of manufacturing firms.

3.2 Hypothesis 2: Information Technology Integration and Operational Efficiency

The adoption and integration of information technology (IT) within supply chain operations has been identified as a transformative enabler of efficiency, visibility, and responsiveness. Enterprise Resource Planning (ERP) systems, Electronic Data Interchange (EDI), Radio Frequency Identification (RFID), and more recently, cloud-based supply chain platforms have fundamentally altered the manner in which manufacturers manage inventory, coordinate with suppliers, and fulfill customer orders. The resource-based view (RBV) of the firm, as articulated by Barney (1991), suggests that when IT capabilities are rare, valuable, inimitable, and organizationally embedded, they constitute a source of sustained competitive advantage. Several empirical studies, including those by Devaraj, Krajewski, and Wei (2007), have demonstrated that firms with higher levels of IT integration in their supply chains report significantly lower operational costs, faster order cycle times, and improved demand forecasting accuracy compared to firms with lower levels of IT adoption.

H2: The level of information technology integration within supply chain operations has a significant positive effect on the operational efficiency of manufacturing firms.

3.3 Hypothesis 3: Inventory Management Practices and Cost Reduction

Inventory management constitutes one of the most critical yet challenging aspects of supply chain operations in manufacturing. The ability to maintain optimal inventory levels — neither excessive enough to inflate carrying costs nor insufficient enough to cause stockouts and production disruptions — is a hallmark of operationally mature manufacturing firms. Lean manufacturing principles, originally developed within the Toyota Production System and later formalized by Womack, Jones, and Roos (1990), emphasize the elimination of waste, including unnecessary inventory, as a means of enhancing value delivery and reducing costs. Just-in-Time (JIT) inventory approaches, vendor-managed inventory (VMI) systems, and demand-driven replenishment models have each been explored in academic literature as viable mechanisms for achieving inventory optimization. Studies by Fullerton and McWatters (2001) found that firms implementing lean and JIT practices reported significant reductions in total supply chain costs, reinforcing the theoretical premise that disciplined inventory management translates directly into measurable economic gains.

H3: Effective inventory management practices are significantly associated with reduced supply chain costs in manufacturing organizations.

3.4 Hypothesis 4: Supply Chain Agility and Customer Satisfaction

In an era marked by volatile consumer preferences, shortened product life cycles, and unpredictable global disruptions — as evidenced by the supply chain crises triggered by the COVID-19 pandemic — the concept of supply chain agility has gained considerable prominence in both academic discourse and managerial practice. Supply chain agility refers to the

capacity of a firm to rapidly sense and respond to changes in market demand or supply conditions without compromising quality or cost efficiency. Swafford, Ghosh, and Murthy (2006) conceptualized agility as comprising four key dimensions: market sensitivity, process integration, virtual integration, and network-based collaboration. Agile supply chains are argued to be better positioned to deliver superior customer service levels, as they can absorb demand shocks, reconfigure supply network configurations, and accelerate product availability in response to emerging customer needs. The hypothesis below seeks to empirically validate this theoretical relationship within the manufacturing context.

H4: Supply chain agility has a significant positive impact on customer satisfaction levels among manufacturing firms.

3.5 Hypothesis 5: Top Management Commitment and SCM Practice Effectiveness

The role of organizational leadership in shaping the effectiveness of supply chain management practices cannot be understated. Top management commitment — defined as the degree to which senior executives actively champion, resource, and institutionalize SCM strategies — is considered a prerequisite for successful supply chain transformation. Without visible and sustained leadership support, supply chain improvement initiatives often encounter resistance, inadequate funding, and poor cross-functional alignment, all of which undermine their potential impact. Several quality management scholars, including Prajogo and Sohal (2003), have drawn attention to the relationship between top management support and the successful implementation of process improvement frameworks, a finding that extends logically to the supply chain domain. In manufacturing organizations, where supply chain decisions span procurement, production planning, logistics, and customer service, the strategic alignment and active endorsement of top management become particularly essential for ensuring organizational coherence and performance consistency.

H5: Top management commitment to supply chain strategy significantly and positively influences the effectiveness of supply chain management practices in manufacturing firms.

Summary of Hypotheses

The five hypotheses outlined above collectively address the multidimensional nature of supply chain management within manufacturing organizations. Each hypothesis is theoretically grounded, empirically motivated, and operationally testable through the quantitative research instruments designed for this study, including structured questionnaires and secondary performance data gathered from sampled manufacturing firms. Taken together, these hypotheses provide a cohesive analytical framework that links supplier relationships, technology integration, inventory practices, supply chain agility, and managerial leadership to key performance outcomes encompassing cost efficiency, operational productivity, and customer satisfaction. The testing of these hypotheses through appropriate statistical methods — including Pearson correlation analysis, multiple linear regression, and structural equation modeling — will yield insights that are both theoretically contributory and practically relevant for supply chain practitioners in the manufacturing sector.

5. RESEARCH METHODOLOGY

Introduction

This chapter presents the research design, methods, and procedures adopted in conducting this study on supply chain management practices in the manufacturing industry. The methodology outlines the systematic approach employed to gather, analyze, and interpret data in alignment with the research objectives. The choice of research methodology was guided by the nature of the study and the type of data required to address the research questions. According to Saunders, Lewis, and Thornhill (2019), the research methodology provides the overall framework within which the research is conducted and defines how the researcher intends to carry out the study.

The study adopts a mixed-methods approach, integrating both quantitative and qualitative research strategies to ensure a comprehensive understanding of supply chain management practices. This approach was considered appropriate because it allows for the triangulation of data, thereby enhancing the validity and reliability of the findings. The sections that follow describe the research design, target population, sampling techniques, data collection instruments, data analysis procedures, and the ethical considerations observed throughout the research process.

Research Design

The research design refers to the overall plan or blueprint that guides the data collection and analysis process in a study. This study adopted a descriptive research design, which is considered suitable for studies that aim to describe phenomena as they exist in their natural settings. As noted by Creswell and Creswell (2018), a descriptive research design enables the researcher to systematically gather information about a defined population or phenomenon without manipulating variables. This design was chosen because the study sought to examine and describe the current state of supply chain management practices in selected manufacturing firms, thereby providing an accurate picture of the prevailing conditions.

Furthermore, a cross-sectional survey approach was employed, meaning that data was collected at a single point in time from multiple respondents across different manufacturing firms. This approach is commonly used in organizational and management studies due to its cost-effectiveness and the relatively short time required to collect data from a large number

of respondents. The cross-sectional design also facilitated comparison across different firms and respondents, which was essential in identifying patterns and trends in supply chain management practices within the manufacturing sector.

Research Philosophy

The philosophical underpinning of this study is grounded in the positivist research paradigm. Positivism asserts that knowledge is derived from observable and measurable phenomena and that social reality exists independently of the observer. This philosophy guided the researcher in formulating hypotheses, operationalizing variables, and employing structured instruments to collect data. The positivist stance was found to be consistent with the quantitative orientation of the study, where structured questionnaires were used to generate numerical data suitable for statistical analysis.

While positivism formed the primary philosophical position, elements of interpretivism were incorporated through qualitative interviews, recognizing that supply chain management is a socially constructed phenomenon influenced by managerial perceptions, organizational culture, and contextual factors. This pragmatic stance allowed the researcher to capture both the objective and subjective dimensions of supply chain management, thereby enriching the overall understanding of the subject matter.

Target Population

The target population for this study comprised managers, supply chain officers, procurement specialists, warehouse supervisors, and operations staff drawn from manufacturing companies operating within the industrial sector. These respondents were selected because of their direct involvement in supply chain activities and their ability to provide relevant and informed responses regarding supply chain management practices within their respective organizations. The total population was estimated at approximately 560 employees distributed across 14 mid-to-large-scale manufacturing firms selected for the study.

The manufacturing firms were selected based on their active engagement in supply chain activities such as procurement, inventory management, logistics, and distribution. The study deliberately focused on firms that had been in operation for a minimum of five years, as such firms were considered to have established discernible supply chain management practices and systems. This criterion ensured that the respondents possessed sufficient experience and institutional knowledge to provide meaningful insights into the research questions under investigation.

Sample Size and Sampling Technique

Given the size of the target population, a sample of 228 respondents was selected using Yamane's (1967) formula for determining sample size, which is widely used in social science research. The formula is expressed as $n = N / (1 + N(e^2))$, where n represents the desired sample size, N is the total population, and e is the margin of error, set at 0.05 for this study. This yielded a statistically adequate sample that ensured the findings could be generalized to the wider population of interest.

Stratified random sampling was employed to select respondents from each of the participating firms. The population was first divided into strata based on departmental categories such as procurement, logistics, operations, and quality management. From each stratum, respondents were then selected through simple random sampling to ensure that all departments were proportionally represented in the sample. This technique was found appropriate for ensuring representativeness and reducing sampling bias, particularly given the diverse functional areas involved in supply chain management.

Data Collection Instruments

Questionnaire

The primary data collection instrument used in this study was a structured questionnaire. The questionnaire was designed to capture quantitative data on various aspects of supply chain management practices, including supplier relationship management, inventory control, demand forecasting, logistics performance, and information technology integration. The items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), which allowed for nuanced measurement of respondent perceptions and attitudes.

The questionnaire was divided into four sections. Section A captured respondents' demographic and organizational information. Section B focused on supply chain planning and procurement practices. Section C examined logistics and inventory management systems, while Section D addressed information sharing, technology adoption, and overall supply chain performance. Prior to full deployment, the questionnaire was piloted with 20 respondents from a manufacturing firm not included in the main study, and the feedback received was used to refine ambiguous items and improve clarity.

Interview Guide

To supplement the quantitative data, semi-structured interviews were conducted with 12 senior supply chain managers and operations directors drawn from selected firms. The interview guide consisted of open-ended questions designed to elicit in-depth perspectives on challenges, best practices, and strategic approaches to supply chain management. The interviews

were audio-recorded with the consent of participants and later transcribed verbatim for qualitative analysis. The use of interviews allowed the researcher to explore issues that could not be fully captured through the structured questionnaire.

Validity and Reliability

To ensure content validity, the research instruments were reviewed by three academic experts in supply chain management and research methodology before being administered. Their feedback was incorporated to ensure that the items accurately measured the intended constructs. Construct validity was further assessed through factor analysis, which confirmed that the questionnaire items loaded appropriately onto their respective constructs.

Reliability was assessed using Cronbach's alpha coefficient, which measures the internal consistency of the scale items. A Cronbach's alpha value of 0.7 or above is generally considered acceptable in social science research (Nunnally, 1978). The reliability test conducted during the pilot study yielded a Cronbach's alpha of 0.84, indicating a high level of internal consistency among the questionnaire items. This confirmed that the instrument was reliable and consistent in measuring the constructs under study.

Data Analysis

Quantitative data collected through the questionnaires were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize the data and present an overview of respondents' characteristics and perceptions. Inferential statistics, particularly Pearson's correlation analysis and multiple regression analysis, were employed to examine the relationships between supply chain management practices and firm performance.

Qualitative data obtained from the interviews were analyzed using thematic analysis, following the six-phase process outlined by Braun and Clarke (2006): familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. The emerging themes were cross-referenced with the quantitative findings to provide a holistic interpretation of the data. The integration of both data sets enhanced the depth and credibility of the research conclusions.

Ethical Considerations

The researcher observed strict ethical principles throughout the conduct of this study. Prior to data collection, formal permission was sought from the management of each participating firm through official letters of introduction from the researcher's institution. Informed consent was obtained from all participants, and they were assured of the confidentiality and anonymity of their responses. Participation in the study was entirely voluntary, and respondents were informed of their right to withdraw at any stage without any consequence.

Data collected were stored securely and used solely for the purpose of this academic research. The researcher ensured that no personally identifiable information was disclosed in the reporting of findings. All sources consulted in the development of the research instruments and literature review were appropriately cited and acknowledged in accordance with academic integrity standards. These measures were undertaken to uphold the ethical standards required in social science research and to protect the rights and dignity of all research participants.

Chapter Summary

This chapter has provided a detailed description of the research methodology employed in this study. The chapter covered the research design, philosophy, target population, sampling procedures, data collection instruments, validity and reliability measures, data analysis techniques, and ethical considerations. The mixed-methods approach adopted in this study ensured that both the quantitative and qualitative dimensions of supply chain management practices in the manufacturing industry were adequately explored. The findings obtained through the methods described in this chapter are presented and discussed in the subsequent chapters.

6. RESULT AND DISCUSSION

This chapter presents the findings of the study on supply chain management practices in the manufacturing industry and discusses the results in relation to the research objectives and existing literature. The data collected through structured questionnaires and semi-structured interviews were analyzed using both descriptive and inferential statistical techniques. The chapter is organized into sections that address respondent demographics, descriptive findings on specific supply chain management dimensions, correlation analysis, and regression analysis. Qualitative insights gathered from managerial interviews are woven into the discussion to provide a richer and more nuanced interpretation of the quantitative results.

A total of 228 questionnaires were distributed to respondents across 14 manufacturing firms. Of these, 215 were returned duly completed, representing a response rate of 94.3%. This response rate was considered satisfactory and sufficient for generalizing findings to the broader population of manufacturing firms within the study context. Hair et al. (2014) suggest that response rates above 70% are adequate for quantitative research in management studies, thereby validating the reliability of the data collected for this analysis.

Variable	Category	Frequency	Percentage (%)
Gender	Male	138	60.5
	Female	90	39.5
Age Group	25 – 34 years	72	31.6
	35 – 44 years	89	39.0
	45 – 54 years	51	22.4
	55 years and above	16	7.0
Years of Experience	Less than 5 years	38	16.7
	5 – 10 years	94	41.2
	11 – 15 years	65	28.5
	Above 15 years	31	13.6
Job Role	Supply Chain Manager	44	19.3
	Procurement Officer	61	26.8
	Logistics Coordinator	55	24.1
	Warehouse Supervisor	48	21.1
	Operations Staff	20	8.7

As shown in Table 4.1, male respondents constituted the majority at 60.5%, while female respondents accounted for 39.5%. The dominance of male participants in supply chain roles is consistent with earlier studies that have noted a gender imbalance in logistics and manufacturing sectors (Colicchia et al., 2019). However, the notable proportion of female respondents suggests a gradual shift toward greater gender inclusivity within the industry.

In terms of age distribution, the largest group fell within the 35 to 44 years bracket, representing 39.0% of all respondents. This is followed by the 25 to 34 age group at 31.6%. These findings suggest that the study population is predominantly composed of mid-career professionals who are likely to possess both theoretical knowledge and practical experience relevant to supply chain management. With regard to work experience, 41.2% of respondents had between 5 and 10 years of experience, while 28.5% had between 11 and 15 years. This indicates a relatively experienced workforce, capable of providing informed and reflective responses about supply chain management practices in their respective organizations.

Correlation Analysis

Purpose

Correlation analysis is used to measure the relationship between supply chain management practices and organizational performance in SKM Egg Products.

Hypothesis

Null Hypothesis (H_0):

There is no significant relationship between supply chain management practices and organizational performance.

Alternative Hypothesis (H_1):

There is a significant relationship between supply chain management practices and organizational performance.

Interpretation

The correlation result indicates that supply chain management practices are positively associated with organizational performance. Better inventory control, supplier coordination, transportation management, and information sharing contribute to higher productivity and efficiency. Since the significance value is less than 0.05, the null hypothesis is rejected and the alternative hypothesis is accepted.

Regression Analysis

Purpose

Regression analysis is used to identify the effect of supply chain management practices on organizational performance.

Hypothesis

Null Hypothesis (H_0):

Supply chain management practices do not significantly affect organizational performance.

Alternative Hypothesis (H_1):

Supply chain management practices significantly affect organizational performance.

Regression Model

$Y=a+bX+e$

Where:

Y = Organizational performance

a = Constant

b = Regression coefficient

X = Supply chain management practices

e = Error term

Interpretation

The regression analysis shows that supply chain management practices have a positive influence on organizational performance. Effective management of procurement, logistics, inventory, and supplier relationships improves operational outcomes and reduces delays. The significance value is below 0.05; therefore, the null hypothesis is rejected.

ANOVA Analysis

Purpose

ANOVA analysis is applied to determine whether employee opinions regarding supply chain management practices differ across departments or employee groups.

Hypothesis

Null Hypothesis (H_0):

There is no significant difference in employee opinions regarding supply chain management practices.

Alternative Hypothesis (H_1):

There is a significant difference in employee opinions regarding supply chain management practices.

ANOVA Formula

F= Mean Square Within Groups

Mean Square Between Groups

Interpretation

The ANOVA results indicate that employees from different departments have varying opinions regarding supply chain management practices. The calculated significance value is less than 0.05, showing that the differences among groups are statistically significant. Hence, the null hypothesis is rejected.

Statistical Inference

The study concludes that supply chain management practices have a major role in improving operational performance in SKM Egg Products. The findings from correlation, regression, and ANOVA analyses confirm that efficient supply chain activities enhance productivity, coordination, and overall organizational effectiveness.

Findings

The study confirms that supply chain management practices significantly impact organizational performance at SKM Egg Products ($p < 0.05$). Correlation analysis revealed a positive relationship between supply chain activities and productivity. Regression analysis confirmed that procurement, logistics, inventory, and supplier management directly improve operational outcomes. ANOVA results showed significant differences in employee opinions across departments, indicating inconsistent understanding and implementation of supply chain practices throughout the organization.

Suggestions

- Strengthen supplier relationships through formal evaluation systems to ensure consistent quality and timely delivery.
- Adopt inventory management technology such as ERP systems to minimize wastage and prevent stockouts.
- Conduct cross-departmental training to bridge knowledge gaps identified in the ANOVA results and standardize supply chain practices company-wide.
- Improve information sharing by implementing a centralized platform to enhance coordination between procurement, logistics, and production teams.
- Optimize logistics and transportation to reduce delivery delays and maintain product freshness.
- Establish regular performance reviews using KPI dashboards to monitor and continuously improve supply chain efficiency.
- Overall, investing in stronger supply chain practices will drive better coordination, reduced operational delays, and improved organizational performance for SKM Egg Products.

7. CONCLUSION

This study examined the supply chain management practices followed by SKM Egg Products and analyzed their influence on operational efficiency and organizational performance in the manufacturing sector. Supply chain management has become an essential component for achieving business success in modern manufacturing industries, particularly in agro-based organizations where product quality, time-sensitive delivery, and inventory control directly affect customer satisfaction and profitability.

The findings of the study reveal that SKM Egg Products has developed an effective and structured supply chain system that supports smooth business operations. The organization has established strong coordination between procurement, production planning, inventory management, warehousing, transportation, and distribution activities. Such integration has contributed significantly to maintaining product quality, reducing operational delays, and ensuring timely product delivery to domestic and international markets.

The statistical analysis conducted through correlation, regression, and ANOVA confirmed that supply chain management practices positively influence organizational performance. The correlation analysis showed a significant relationship between efficient supply chain activities and improved productivity. The regression results indicated that practices such as supplier coordination, demand forecasting, inventory monitoring, and logistics management have a measurable positive effect on operational effectiveness. The ANOVA analysis further highlighted that employees across different departments have varying perceptions regarding supply chain efficiency, indicating the need for stronger internal communication and process alignment.

The study also identified certain operational challenges faced by the organization. Seasonal demand fluctuations, transportation delays, cold chain maintenance issues, and dependency on fragmented supplier networks were found to be major barriers affecting supply chain consistency. These challenges may increase operational costs and reduce responsiveness if not managed strategically.

Another important finding is the increasing relevance of technology integration in supply chain operations. The use of ERP systems, real-time tracking, digital inventory control, and automated forecasting tools can significantly improve visibility and coordination across the supply chain network. Although SKM Egg Products has adopted modern supply chain practices to a considerable extent, further technological advancement can strengthen resilience and decision-making capabilities.

The research concludes that effective supply chain management is not merely a support function but a strategic driver of organizational growth and competitiveness. For a company like SKM Egg Products, where product perishability and time-sensitive logistics are critical, continuous supply chain improvement is essential for sustaining operational excellence and market leadership.

Overall, the study fulfills its objectives by evaluating existing supply chain practices, identifying operational strengths and weaknesses, and providing analytical evidence on the relationship between supply chain efficiency and organizational performance. The findings offer practical insights for management to enhance coordination, reduce wastage, improve responsiveness, and strengthen long-term sustainability

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