Int Journal of Social Sciences Management and Entrepreneurship 8(2): 369-386 2024

ISSN 2411-7323

www.sagepublishers.com

LEAN SUPPLY CHAIN MANAGEMENT AND PERFORMANCE OF CEMENT MANUFACTURING FIRMS IN MACHAKOS COUNTY, KENYA

[1] Mbevi Patricia Musenya, [2] Dr. Ndeto Charles

[1]Masters Student, Jomo Kenyatta University of Agriculture and Technology
[2]Lecturer, Jomo Kenyatta University of Agriculture and Technology

ABSTRACT

In Kenya, cement manufacturing supports the construction industry, which is a major driver of economic growth and employment. To remain competitive in the cement industry as well as increase efficiency and effectiveness, various firms have adopted lean supply chain management. The use of lean supply chain management contributes to improved operational efficiency, cost reduction, and overall competitiveness in the industry. However, despite the adoption of lean supply chain management, firms in the cement manufacturing industry in Kenya have been experiencing a decline in their profitability, market share and customer satisfaction. Therefore, the general objective of the research was to examine the effect of lean supply chain management on performance of cement manufacturing firms in Machakos County, Kenya. The specific objective of the study was to examine the effect of quality management and distribution management on performance of cement manufacturing firms in Machakos County, Kenya. The study adopted a descriptive research design. The target population was seventy-two (72) heads and assistant heads of production, procurement, store/warehouse, transport, sales and marketing as well as quality assurance departments in 6 cement manufacturing firms in Machakos County. The study used a census approach and hence the whole population was included in the study. The research made use of both primary as well as secondary data. Secondary data was collected from the annual; reports of cement manufacturing firms. Primary data was obtained by use of semi-structured questionnaires. A pilot test was conducted in Ndovu Cement to assess the reliability and validity of the instrument for research. Both quantitative and qualitative data was generated by the questionnaires. Qualitative data was analyzed using thematic analysis, and the results were presented narratively. Descriptive as well as inferential statistics will be employed in analyzing quantitative data with an assistance of SPSS version 25 statistical software. Descriptive statistics comprised of mean, standard deviation, percentages and frequency distribution. Inferential data analysis was carried out using Pearson correlation coefficient and linear regression analysis. The study found that quality management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya. In addition, the study found that distribution management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya. The study recommends regular training programs for updating employees on changes in quality assurance procedures. Also, cement manufacturing firms should employ advanced technology for accurate and real-time inventory tracking. Further, the management of cement manufacturing firms should implement a real-time distribution management system.

Key Words: Lean Supply Chain Management, Performance of Cement Manufacturing Firms, Quality Management, Distribution Management

Background to the Study

Cement manufacturing firms play a vital role in national economies, contributing significantly to economic development, infrastructure development, and overall growth (Karuga & kibe, 2023). However, due to increasing competition, the changing business environment as well as the changing needs of the consumers, the performance of manufacturing firms has been fluctuating. Manufacturing firms are often sensitive to changes in market demand, economic conditions, and competition (Panigrahi & Sahoo, 2021)). Fluctuations in customer demand, economic downturns, or increased competition impact the performance of manufacturing firms. In addition, issues within the supply chain, such as disruptions in the availability of raw materials, delays in transportation, or changes in supplier relationships, can lead to fluctuations in production and overall performance.

Lean supply chain management plays an important role in the elimination of waste, optimization of processes, and improvement of the flow of products and information throughout the entire supply chain (Hanaa & Labib, 2020). According to Kimari and Muli (2022), lean supply chain management (SCM) is of significant importance for organizations aiming to enhance efficiency, reduce waste, and create a responsive and customer-centric supply chain. Lean SCM is centered around the elimination of waste throughout the supply chain. By minimizing unnecessary steps, excess inventory, overproduction, and inefficient processes, organizations can significantly reduce costs and improve overall resource utilization (Anisere-Hameed & Bodunde, 2021)).

Lean SCM focuses on eliminating waste and optimizing processes, leading to cost reductions throughout the supply chain. By minimizing excess inventory, reducing lead times, and streamlining operations, manufacturing firms can achieve higher cost efficiency (Gołaś, 2020). Further, lean principles, such as just-in-time production, value stream mapping, and continuous improvement, enhance operational efficiency. These results in smoother and faster production processes, reduced cycle times, and improved overall workflow. In addition, lean SCM places a strong emphasis on total quality management (Yankah & Agyapong, 2022). By identifying and eliminating defects at the source, implementing standardized processes, and promoting a culture of continuous improvement, manufacturing firms can enhance the quality of their products.

LSCM has been adopted by manufacturing firms around the world in a variety of manufacturing firms to improve efficiency, reduce costs, and improve customer satisfaction. LSCM has been adopted by fast food manufacturing firms in India to reduce lead times, improve quality, increase customer satisfaction and reduce costs (Panigrahi & Sahoo, 2021). McDonald's India has been using LSCM to improve the efficiency of its supply chain. The company has implemented a number of LSCM initiatives, such as reducing the number of suppliers, consolidating warehouses, and implementing pull production. KFC India has also been using LSCM to improve the efficiency of its supply chain. The company has implemented a number of LSCM initiatives, such as implementing value stream mapping, reducing lead times, and improving inventory management.

The adoption of Lean Supply Chain Management (LSCM) in Africa has been growing in recent years, as businesses across the continent seek to improve efficiency, reduce costs, and enhance customer satisfaction. In addition, African businesses are facing increasing competition from both domestic and international companies and hence LSCM helps businesses to improve their efficiency and reduce their costs, making them more competitive in the global marketplace. In Egypt, Hanaa and Labib (2020) observed that lean supply chain practices, including value stream mapping, supplier relationship management, customer relationship management, just in time and

information technology management, had a positive effect on the performance in Egypt manufacturing industry.

Lean supply chain management has been shown to be effective in a variety of industries, including food manufacturing. A growing number of food manufacturing firms are adopting lean manufacturing practices in order to improve their supply chain performance. Among food manufacturing firms in Nairobi County, Ongaro (2019) indicates that just in time production, pre-production planning, inventory management, total quality control and, supplier relationship management lean manufacturing practices positively and significantly influenced supply chain performance of food manufacturing firms Lean supply chain management helps food companies in Kenya to improve the quality of their products and services by reducing defects and improving processes. This can lead to increased customer satisfaction and reduced food recalls.

Statement of the Problem

In Kenya, cement manufacturing supports the construction industry, which is a major driver of economic growth and employment. It provides jobs for a wide range of skilled and unskilled workers, from construction laborers to engineers and architects. To remain competitive in the cement industry as well as increase efficiency and effectiveness, various firms have adopted lean supply chain management. According to Ochieng (2021), the use of lean supply chain management contributes to improved operational efficiency, cost reduction, and overall competitiveness in the industry. However, despite the adoption of lean supply chain management, firms in the cement manufacturing industry in Kenya have been experiencing a decline in their profitability, market share and customer satisfaction.

Munyasya and Muathe (2023) observed that despite the increasing demand for cement in the construction industry in Kenya, the profitability of cement manufacturing firms has been fluctuating. For instance, return on assets among cement manufacturing firms in Kenya declined from 18.2% in 2017 to 16.9% in 2018, increased to 17.4% in 2019, but later decreased to 15.09% in 2020 and 14.5% in 2021 (Kenya Association of Manufacturers, 2022). In addition, some of the cement companies listed in the Nairobi stock exchange have been recording losses over the years. For instance, Athi River Mining Cement Company was put into administration in the year 2015 (it was later sold to Devki group) while East African Portland Cement has been posting losses for the period between 2017 and 2022. In addition, customer satisfaction index declined from 87.5% in 2018 to 79.7% in 2019, 76.6% in 2020 and 74.8% in 2021, which was attributed to inadequate supply of cement products to the market (Kenya Association of Manufacturers, 2022). It is therefore important to examine the effect of lean supply chain management and performance of cement manufacturing firms in Machakos County, Kenya.

Various studies have been conducted on lean supply chain management and performance of firms in Kenya. For instance, Ochieng (2021) examined the effect of lean manufacturing practices on supply chain performance of sugar manufacturing firms in Western Kenya; Oure and Thogori (2022) studied the effect of lean supply chain practices on performance of agro processing firms in Nairobi Metropolis; and Ongaro (2019) conducted a study on the effect of lean manufacturing practices on supply chain performance of food manufacturing firms in Nairobi County. However, Ochieng (2021) focused on sugar manufacturing firms, Oure and Thogori (2022) focused on agro processing firms and Ongaro (2019) focused on food manufacturing firms. Supply chains as well as their stakeholder differ from one industry to another and hence findings from one industry cannot be generalized to another industry. Therefore, this study sought to examine the effect of quality management and distribution management on performance of cement manufacturing firms in Machakos County, Kenya.

General Objective

The general objective of the research was to examine the effect of lean supply chain management on performance of cement manufacturing firms in Machakos County, Kenya.

Specific Objectives

i. To examine the effect of quality management on performance of cement manufacturing firms in Machakos County, Kenya.
ii. To examine the effect of distribution management on performance of cement manufacturing firms in Machakos County, Kenya.

Theoretical Framework

Juran's theory of Quality Management

Juran theory of Quality was developed in 1986 by Dr. Joseph M. Juran. The theory holds that quality is the capability of a product to meet the customer needs hence leading to client satisfaction. Further, the theory argues that quality is concerned with all the activities that an organization engages in to ensure their products meet customer requirements. Quality is composed of three managerial processes; quality control, quality planning as well as quality enhancement (Jalnasow, 2019). The theory argues that there will be constant waste in case there is no change; during the change, the cost will increase; however, after the change (improvement) there will be increased margins and there will also be a recoup of the increased costs. To ensure success in quality improvement project, there is need for good planning and good control of all quality improvement actions (Abimbola, Ekpudu & Kuye, 2021).

According to Juran's Theory of Quality, there are three basic steps to progress that need to be implemented by an organization in order to realize improved quality. The first step is that organizations need to accomplish the improvements that are structured on frequent basis with urgency and high level of commitment. In the second step, an organization needs to build a wide training program. The third step is that an organization needs to enhance commitment as well as leadership to enhance management. According to the theory, there are ten steps to ensure quality improvement (Jalnasow, 2019). These steps entails, creation of awareness on the opportunities to be improved, determining the improvement on goals, proper organization to attain the set goals, provision of training, initialization of projects, recognizing performance, monitoring progress, reporting the results, tracking achievement of improvement and repeating the entire process.

Juran's theory of quality management was used in explaining the effect of quality management on performance of cement manufacturing firms in Machakos County, Kenya. It is a comprehensive approach to quality that emphasizes the importance of top-down management commitment, process improvement, and the active involvement of all employees in achieving and maintaining high-quality products and services. The theory consists of three key processes: quality planning, quality control and quality improvement (Vanich chinchai, 2019). Cement manufacturing firms use quality planning to define specific quality goals and objectives that align with customer expectations and industry standards. Implementing robust quality control processes, such as regular inspections, testing, and process monitoring, can help cement manufacturers identify and rectify defects or variations in their production processes. In addition, embracing quality improvement as a core principle allows cement manufacturing firms to continuously enhance their processes.

Bullwhip Effect Theory

The bullwhip effect was first introduced by Forrester (1958). The Bullwhip Effect is a phenomenon in supply chain management where small fluctuations in demand at the consumer level can lead to progressively larger fluctuations in demand further upstream in the supply chain. This amplification of demand variability resembles the cracking of a whip, where a small flick at the handle results in a much larger movement at the whip's tip. The Bullwhip Effect can have significant implications for inventory management, production planning, and overall supply chain efficiency (Duan & Huo, 2021).

The Bullwhip Effect Theory explores the factors and dynamics contributing to this phenomenon. It suggests that several factors, including order batching, lead time variability, and information delays within the supply chain, contribute to the amplification of demand fluctuations. When companies place orders in batches rather than in response to actual demand, it can lead to an overreaction to perceived changes in demand (Liu & Zhou, 2021). Additionally, variability in lead times and information delays between different entities in the supply chain can create distortions in demand information, causing each participant to adjust their orders based on imperfect and outdated information.

To mitigate the Bullwhip Effect, supply chain managers often emphasize the importance of accurate demand forecasting, reducing order batching, improving communication and information-sharing practices among supply chain partners, and adopting responsive and flexible inventory management strategies (Zhu & Balakrishnan, 2020). The Bullwhip Effect Theory is valuable for understanding the complexities of supply chain dynamics and developing strategies to enhance the overall efficiency and responsiveness of the supply chain.

Bullwhip Effect Theory was used to explain the effect of distribution management on performance of cement manufacturing firms in Machakos County, Kenya. The Bullwhip Effect refers to the phenomenon where small fluctuations in customer demand led to increasingly significant variations in inventory levels, production schedules, and orders as you move up the supply chain. In the cement manufacturing industry, variations in demand can have a cascading effect on raw material procurement, production schedules, and distribution. Inefficient distribution management can contribute to the Bullwhip Effect (Karuga & kibe, 2023). For instance, inaccurate demand forecasting, erratic order patterns, and long lead times in distribution can result in excessive inventory accumulation, stockouts, and costly expedited shipments. These inefficiencies can disrupt the supply chain, increase carrying costs, and negatively affect performance.

Conceptual Framework

Conceptual framework is a diagram that illustrates connection between independent and dependent variables (Devi, 2019). Figure 1 depicts the link between independent and dependent variables. The independent variables included quality management and distribution management. The dependent variable was performance of cement manufacturing firms in Machakos County.

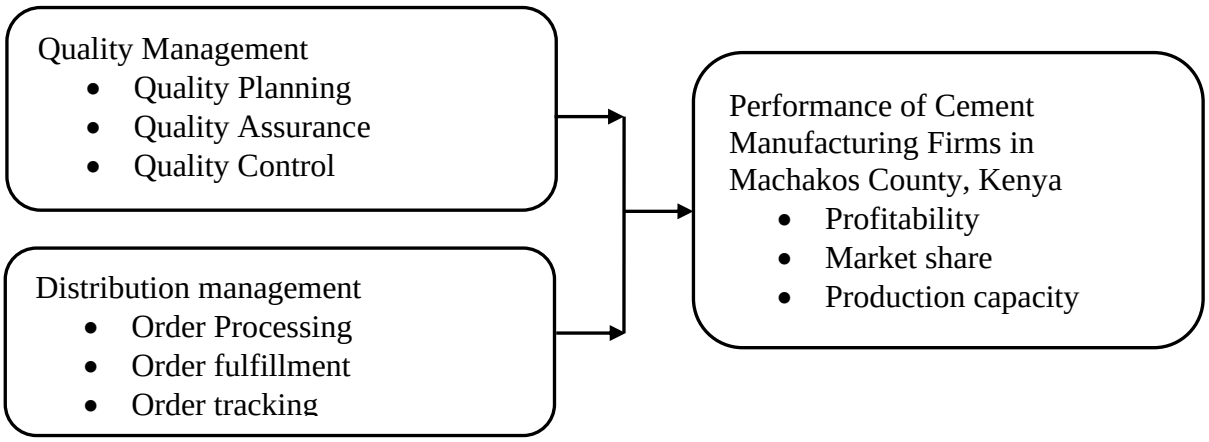

Figure 1: Conceptual Framework

Quality Management

Quality management plays a pivotal role in the performance of cement manufacturing firms. It encompasses three key components: quality planning, quality assurance, and quality control, each of which contributes to the overall success and competitiveness of these firms (Vanichchinchai, 2019). Quality management is a comprehensive approach that encompasses the systematic processes, methodologies, and strategies implemented by organizations to ensure and enhance the quality of their products, services, and operations (Muiruri & Peterson, 2020). The primary goal of quality management is to meet or exceed customer expectations by consistently delivering products or services that adhere to established standards and specifications. This involves a continuous cycle of planning, monitoring, controlling, and improving all aspects of an organization's processes. Key components of quality management include quality planning, quality control, and quality assurance (Gambi & Lizarelli, 2020).

Quality planning is a fundamental aspect of quality management that involves the systematic and proactive development of processes, methods, and strategies to ensure that products, services, or projects meet predefined quality standards and satisfy customer requirements (Vanichchinchai, 2019). The primary objective of quality planning is to prevent defects, errors, or deviations from occurring during the production or service delivery process. It typically includes the identification of quality objectives, specifications, and critical processes, as well as the establishment of clear guidelines and criteria for quality control and assurance. Quality planning is a forward-looking process that takes place before actual production or service delivery, allowing organizations to anticipate potential issues, allocate resources effectively, and implement measures to achieve and maintain high-quality outcomes (Gambi & Lizarelli, 2020).

Distribution Management

Distribution management, also known as distribution logistics, involves the systematic planning, implementation, and control of the movement and storage of goods from the point of origin to the final destination (Oluwakoya & Ogundipe, 2022). It encompasses a range of activities, including transportation, warehousing, order fulfillment, and inventory management, with the overarching goal of ensuring timely and efficient delivery of products to customers. Distribution management is a critical component of the supply chain, focusing on the physical flow of goods and information (Mbithe & Charles, 2021). Key elements include route optimization, warehouse management, order processing, and transportation coordination. Effective distribution management helps organizations minimize lead times, reduce costs, optimize inventory levels,

and enhance overall customer satisfaction. Distribution management, which includes order processing, order fulfillment, and order tracking, plays a crucial role in the performance of cement manufacturing firms. It directly impacts various aspects of a company's operations and overall success (Obiero, 2019).

Order processing is a crucial component of the supply chain and business operations that involves the systematic handling of customer orders from initiation to fulfillment. This process begins when a customer places an order and extends through various stages, including order verification, payment processing, inventory allocation, picking and packing, and finally, shipment or delivery (Vanichchinchai, 2019). Efficient order processing is essential for meeting customer expectations, ensuring accuracy, and maintaining overall supply chain effectiveness. It often involves the use of order management systems and technologies to streamline the workflow, reduce errors, and expedite the fulfillment process (Obiero, 2019). Timely and accurate order processing contributes to customer satisfaction, helps organizations manage inventory levels effectively, and supports the seamless functioning of the entire supply chain. In the context of cement manufacturing, this involves efficiently handling customer requests, ensuring that order details are accurate, and confirming product availability (Munyasya & Muathe, 2023).

Empirical Literature Review

Quality Management and Performance of Manufacturing Firms

Pambreni and Tham (2019) examined the influence of total quality management (TQM) on organization performance of Small and Medium Enterprises (SMEs) in the service sector of Selangor, Malaysia. The study used a descriptive research design and multiple linear regression analysis in the analysis of data. The research findings reveal that the TQM elements, including customer focus, continuous improvement, strategic orientation, and total employee involvement, have a positive and significant effect on organizational performance. The positive findings suggest that the adoption of TQM principles can enhance various aspects of organizational performance for SMEs in Selangor, Malaysia.

In Iraq, Saadia (2021) examined the role of quality management system in promoting innovation in companies. The study used a cross-sectional research deign. The results confirm the first hypothesis, indicating a positive influence of ISO 9001 certification on certain innovation indicators. Additionally, the study finds that different levels of quality contribute to the innovation process in diverse ways. Specifically, for certain domains of innovation, enterprises with a very high level of quality exhibit higher innovation performance than those with average quality, and the latter outperform enterprises with low-quality levels. However, the study notes that the difference in innovation performance between enterprises with average and low-quality levels is not significant.

Gambi and Lizarelli (2020) examined the effect of the impact of quality management practices on innovation in Brazilian manufacturing companies. This study, based on data collected from 132 Brazilian manufacturing companies, utilizes Partial Least Square–Structural Equation Modeling (PLS–SEM) to investigate the direct impact of soft and hard Quality Management (QM) practices on innovation practices and the indirect effect on innovation performance. The study reveals a positive effect of soft QM on hard QM within the manufacturing companies. Soft QM significantly influences innovation practices, while hard QM does not exhibit a significant effect on innovation practices. In addition, soft QM demonstrates a significant positive impact on innovation performance through its influence on innovation practices.

Muiruri and Peterson (2020) conducted a study on the effect of quality management practices on competitiveness of manufacturing firms in Nairobi. The research adopts a descriptive survey research design, utilizing a sample of 50 manufacturing firms. Stratified random sampling is employed to select participants, including operations managers, quality assurance managers, and supply chain managers. Structured questionnaires are used for data collection. A positive and significant correlation is identified, suggesting that firms implementing benchmarking practices tend to be more competitive. In addition, a positive and significant relationship is observed, indicating that continuous improvement efforts contribute to enhanced competitiveness. The overall quality management practices exhibit a positive and significant correlation, emphasizing their role in enhancing firms' competitiveness.

Kinyua and Sije (2023) studied the effect of quality management practices on operational performance of soft drink manufacturing firms in Nairobi County. The research adopted a descriptive survey method, targeting 64 soft drinks manufacturing firms operating in Nairobi County. The unit of observation comprised heads of operations and human resource units in each firm, totaling 128 respondents. The study found a positive impact of continuous improvement practices on the operational performance of soft drinks manufacturing firms in Nairobi County, suggesting that a culture of quality and employee involvement enhances performance. In addition, customer management practices were also positively associated with the operational performance of the studied firms.

Distribution Management and Performance of Manufacturing Firms

Oluwakoya and Ogundipe (2022) examined the effect of third-party logistics providers on the physical distribution of manufactured products. This study focused on examining the influence of third-party logistics providers on the physical distribution of manufactured products, with a case study involving MDS Logistics and the staff of Guinness Nigeria. Employing purposive sampling and a well-structured questionnaire, the study gathered one hundred responses. The tested hypothesis indicates a significant impact of third-party logistics providers on the physical distribution of manufactured products, supported by the chi-square statistical tool.

Mbithe and Charles (2021) examined the influence of distribution management strategies on the performance of cement manufacturing firms in Machakos County. The research utilized a descriptive research design, focusing on 126 logistics and distribution officers across seven cement-manufacturing firms in Machakos County. Primary data was collected through structured questionnaires, pretested for clarity and validity. Statistical Package for Social Science (SPSS) Version 23 was employed for data analysis, using descriptive statistics to portray categories and multiple linear regression analysis to test the significance of independent variables. The findings revealed that a Distribution Management System (DMS) is effective in collecting, displaying, and analyzing real-time or near real-time electric distribution system information. The DMS enables logistics and distribution managers in cement firms to plan and execute complex distribution system operations, increasing efficiency and preventing overloads.

Obiero (2019) examined the effectiveness of streamlined physical distribution to distributor small and medium-sized enterprises in Kericho County. The study employs a descriptive cross-sectional survey design. Census sampling is applied, targeting 48 owner-managers of distributor SMEs, with 42 responding to the questionnaires. Primary data is collected through structured questionnaires, ensuring validity and reliability through construct validity and test-retest reliability. Descriptive statistics, including frequencies, mean, and standard deviation, are used to analyze the three study objectives. Streamlined physical distribution is predominantly adopted in order processing but less so in stock management. Challenges include political interference, unreliable market conditions, and unfair regulations and high taxes. Distributor SMEs need to

improve strategies in transportation, distribution planning, customer service, and inventory management for sustainability, growth, and competitive advantages.

Kiplagat (2019) examined the effect of multi-echelon distribution systems on performance of manufacturing firms in Kenya. A descriptive survey research design is employed, with the target population consisting of top managers from the Kenya Association of Manufacturers (KAM), providing a sampling frame of 903 manufacturing firms. The study draws a sample of 90 respondents and utilizes both semi-structured and structured questionnaires for data collection. SPSS version 20.0 is employed for data analysis, incorporating both descriptive and inferential statistics. The findings indicate significant influences of demand forecasting, ICT integration, distribution control systems, and lead time systems on the performance of manufacturing firms in Kenya. However, organizational policy is found to have no intervening effect on performance and multi-echelon distribution systems.

RESEARCH METHODOLOGY

Research Design

The study adopted a descriptive research design. In a descriptive research design, the researcher observes, records, analyzes, and interprets data without intervening or altering the conditions under study. Descriptive research design is used to identify "what exists" in connection to the variables or conditions in a certain setting and acquire information about the current state of phenomena (Devi, 2019). Descriptive research design is reliable in giving responses to when, how, who and where which are connected to the topic being studied. The data collected in descriptive research is typically analyzed using statistical techniques to identify patterns, trends, or characteristics. Descriptive research design was used in this study because it allows the combination of both qualitative and quantitative research approaches.

Target Population

The target population refers to the specific group or set of individuals or entities that a researcher aims to study, analyze, or draw conclusions about (Saunders, Lewis & Thornhill, 2018). The unit of analysis was all the six cement manufacturing firms in Machakos County. According to Kenya Association of Manufacturers (2022), there are six cement manufacturing firms in Kenya. The unit of observation was heads and deputies of production, procurement, store/warehouse, transport, sales and marketing as well as quality assurance departments. The target population was seventy-two (72) heads and assistant heads of production, procurement, store/warehouse, transport, sales and marketing as well as quality assurance departments in 6 cement manufacturing firms in Machakos County.

Table 3. 1: Target Population

Departments	**Target Population**
Production,	12
Procurement	12
Store/warehouse	12
Transport	12
Sales and marketing	12
Quality assurance	12
Total	**72**

Source: Kenya Association of Manufacturers (2022)

Sample Size and Sampling Techniques

The study used a census approach and hence the whole population was included in the study. A census approach is a data collection method used in research to gather information from an entire population or a complete set of observations (Sileyew, 2019). Unlike sampling methods, which involve studying a subset (sample) of a larger population, the census approach aims to collect data from every individual or unit within the defined population (Latwal, 2020). Because it encompasses the entire population, the census approach is considered highly accurate and is often used when precision is crucial. It minimizes sampling error and ensures that no individuals or units are excluded from the study.

Data Collection Instruments

The research made use of both primary data, which will be obtained by use of semi-structured questionnaires. Structured questions were in form of the nominal scale and Likert scale. Structured questions were involved in an attempt to conserve time and save money, and also encourage faster analysis since they are in immediate applicable form (Saunders, Lewis & Thornhill, 2018). Moreover, unstructured questions were used because they motivate participants to provide a comprehensive response without feeling restricted in disclosing any information. Questionnaires were also used on this study as they guarantee anonymity since some of the information required is sensitive and strategic to certain companies

Pilot study

A pilot study is a small-scale, preliminary research effort conducted before the main research project to test and refine various aspects of the research design. The primary purpose of a pilot study is to identify and address potential issues, assess the feasibility of the research methods, and make necessary adjustments before launching the full-scale investigation (Hall, 2020). It is essentially a trial run that helps researchers fine-tune their approach and enhance the quality and efficiency of the main study. A pilot test was conducted with 10% of the sample size (7 individuals) from the Ndovu Cement to assess the reliability and validity of the instrument for research. According to Devi (2019) 10% of the sample required for a full study should be used in a sample size.

Data Analysis and Presentation

Both quantitative and qualitative data was generated by the questionnaires. Qualitative data was analyzed using thematic analysis, and the results were presented narratively. Thematic analysis is a qualitative research method widely used for analyzing and identifying patterns (themes) within textual data. It involves systematically organizing and interpreting the content of qualitative data, such as interviews, focus group discussions, or open-ended survey responses. Thematic analysis is a flexible and accessible approach that allows researchers to uncover meaningful patterns and gain insights into the experiences and perspectives of participants (Kumar, 2019). Descriptive as well as inferential statistics was employed in analyzing quantitative data with an assistance of SPSS version 25 statistical software. Descriptive statistics comprised of mean, standard deviation, percentages and frequency distribution. Inferential data analysis was carried out using Pearson correlation coefficient and linear regression analysis.

RESEARCH FINDINGS AND DISCUSSIONS

Descriptive Statistics

Descriptive statistics are a set of techniques used to summarize and describe essential features of a dataset or a population. Descriptive statistics in this study include mean, standard deviation and percentages. Closed questions yielded quantitative data, as did items measured on a 5-point Likert scale, with 1 indicating strongly disagree, 2 indicating disagree, 3 indicating moderately agree, 4 indicating agree, 5 indicating strongly agree. Open ended questions yielded qualitative data.

Quality Management

The respondents were asked to indicate their level of agreement on the various aspects of quality management in their organization. The results were as presented in Table 4.1.

Table 4. 1: Aspects Quality Management

Statements	N	Mean	Std. Deviation
The quality planning procedures in our cement manufacturing firm are clear and well-defined.	67	4.149	.359
Communication channels within our organization regarding quality planning are effective.	67	4.000	.676
Stakeholders relevant to quality planning are actively involved in decision-making processes.	67	4.149	.359
The quality standards and specifications for our cement products are consistently met.	67	4.068	.446
Regular training programs are conducted to ensure employees are updated on changes in Quality Assurance procedures.	67	2.328	.877
There is an effective feedback loop in place for continuous improvement in our Quality Assurance system.	67	4.403	.494
Our cement manufacturing firm has effective Quality Control processes in place.	67	4.268	.446
Documentation of Quality Control procedures is comprehensive and easily accessible to relevant personnel.	67	4.134	.343
Our organization conducts regular evaluations to assess the effectiveness of Quality Control initiatives.	67	4.134	.343

The respondents agreed with a mean of 4.403 (Std. Deviation = 0.494) with the statement, indicating that there is an effective feedback loop in place for continuous improvement in the quality assurance system. With a mean of 4.268 (Std. Deviation = 0.446), the respondents agreed that the cement manufacturing firm has effective quality control processes in place. The findings agree with Pambreni and Tham (2019) findings that manufacturing firms should ensure effective quality control processes. With a mean of 4.149 (Std. Deviation = 0.359), the respondents agreed that the quality planning procedures in the cement manufacturing firm are considered clear and well-defined.

With a mean of 4.149 (Std. Deviation = 0.359), the respondents agreed that stakeholders relevant to quality planning are actively involved in decision-making processes. The respondents agreed with a mean of 4.134 (Std. Deviation = 0.343) with the statement, indicating that documentation of quality control procedures is considered comprehensive and easily accessible to relevant personnel. These findings are in concurrence with Saadia (2021) argument that documentation of

quality control procedures should be adequate and easily accessible. With a mean of 4.134 (Std. Deviation = 0.343), the respondents agreed that the organization conducts regular evaluations to assess the effectiveness of Quality Control initiatives.

The respondents agreed with a mean of 4.068 (Std. Deviation = 0.446) with the statement, indicating that the quality standards and specifications for cement products are consistently met. The respondents agreed with a mean of 4.000 (Std. Deviation = 0.676) with the statement, indicating that communication channels within the organization regarding quality planning are perceived as effective. These findings are in line with Gambi and Lizarelli (2020) argument that communication channels used in quality management should be effective. With a mean of 2.328 (Std. Deviation = 0.877), the respondents disagreed with the statement indicating that regular training programs for updating employees on changes in quality assurance procedures.

The respondents were asked to indicate the challenges faced by their organizations during quality management. The respondents indicated that cement production relies on raw materials like limestone, clay, and others. Variability in these raw materials can impact the quality of the final product. They also indicated that cement manufacturing involves a complex series of processes, from raw material preparation to clinker production and grinding. Managing and controlling each step is crucial for quality, but it can be challenging due to the intricacy of the processes. The findings agree with Muiruri and Peterson (2020) findings that although management and control, of quality are important, they can be challenge to an organization. In addition, the respondents indicated that ccompliance with environmental regulations can be challenging, especially as the industry faces increasing scrutiny for its environmental impact. Implementing environmentally friendly practices without compromising quality can be a balancing act. Also, the respondents indicated that ensuring consistent quality through proper testing and monitoring procedures is essential. Challenges may arise in maintaining accurate and reliable testing methods, especially as standards evolve. Also, the respondents indicated that cement manufacturing involves a supply chain that extends from raw material suppliers to distributors. Any disruptions or variations in the supply chain can impact the quality of the final product.

The respondents were asked to indicate possible solutions to the challenges faced during the quality management. The respondents indicated that cement manufacturing firms should establish strict quality control measures for incoming raw materials; work closely with suppliers to ensure consistent quality and explore alternative sources; and invest in technology for real-time monitoring of raw material variations. The respondents also indicated that cement manufacturing firms should implement advanced process control systems to optimize and regulate manufacturing processes; conduct regular process audits to identify and address inefficiencies; and invest in research and development for process improvements. They also indicated that cement manufacturing firms should stay updated on environmental regulations and proactively implement compliance measures; and invest in sustainable technologies and practices to align with environmental standards.

Distribution Management

The respondents were asked to indicate their level of agreement with various statements on various aspects of distribution management in their organizations. The results were as shown in Table 4.2.

Table 4. 2: Aspects of Distribution Management

Statements	N	Mean	Std. Deviation
The inventory control processes in our organization are well-defined and clearly communicated.	67	4.149	.657
Our organization conducts regular evaluations to measure the effectiveness of inventory control initiatives.	67	3.940	.874
Employees involved in inventory control understand the importance of their role in maintaining accurate inventory levels.	67	4.4328	.499
The order processing procedures in our organization are well-defined and clearly communicated.	67	3.897	.953
Our organization has established criteria for quality control during the order processing process.	67	4.000	.550
Documentation of order processing procedures is comprehensive and easily accessible to relevant personnel.	67	4.029	.920
The order tracking system in our organization is user-friendly and easily accessible.	67	4.062	.893
Our organization provides real-time updates to customers throughout the order tracking process.	67	4.031	.687
Our organization conducts regular evaluations to measure the effectiveness of order tracking initiatives.	67	4.149	.657

With a mean of 4.4328 (Std. Deviation = 0.499), the respondents strongly agreed that employees involved in inventory control understand the importance of their role in maintaining accurate inventory levels. With a mean of 4.149 (Std. Deviation = 0.657), the respondents strongly agreed that the organizations conducts regular evaluations to measure the effectiveness of order tracking initiatives. The findings agree with Oluwakoya and Ogundipe (2022) findings that firms should conducts regular evaluations to measure the effectiveness of order tracking initiatives. With a mean of 4.149 (Std. Deviation = 0.657), the respondents strongly agreed that the inventory control processes in the organization are well-defined and clearly communicated. The respondents agreed with a mean of 4.062 (Std. Deviation = 0.893) with the statement, indicating that the order tracking system in the organization is perceived as user-friendly and easily accessible. The respondents agreed with a mean of 4.031 (Std. Deviation = 0.687) with the statement, indicating that the organization provides real-time updates to customers throughout the order tracking process. The findings align with Mbithe and Charles (2021) findings that firms should provide real-time updates to customers throughout the order tracking process.

The respondents agreed with a mean of 4.029 (Std. Deviation = 0.920) with the statement, indicating that documentation of order processing procedures is considered comprehensive and easily accessible to relevant personnel. The respondents agreed with a mean of 4.000 (Std. Deviation = 0.550) with the statement, indicating that the organization has established criteria for quality control during the order processing process. The findings agree with Obiero (2019) observation that firms should establish criteria for quality control during the order processing process. The respondents agreed with a mean of 3.940 (Std. Deviation = 0.874) with the statement, indicating that the organization conducts regular evaluations to measure the effectiveness of inventory control initiatives. The respondents indicated agreement with a mean of 3.897 (Std. Deviation = 0.953) that the order processing procedures in the organization are well-defined and clearly communicated.

The respondents were asked to indicate the challenges faced by their organizations during distribution management. From the findings, the respondents indicated that there was lack of real-time data. Limited visibility into inventory levels across distribution channels can lead to stockouts, overstocking, and inaccurate order fulfillment. There also another challenge of warehouse management inefficiencies. Unoptimized warehouse layouts, manual processes, and lack of automation can contribute to delays, errors, and increased operational costs. Also, managing inventory across various distribution partners requires effective collaboration and communication to ensure accuracy and prevent discrepancies. These findings are in line with Kiplagat (2019) findings that the management of inventory requires effective collaboration and communication to ensure accuracy. The respondents indicated that warehousing and storage costs: Maintaining warehouses in strategic locations can be expensive and minimizing storage requirements while ensuring delivery efficiency is a balancing act.

The respondents were asked to indicate possible solutions to the challenges faced during distribution management. The respondents indicated that the management of cement manufacturing firms should implement a real-time distribution management system. They should gain real-time visibility across warehouses and distribution channels to prevent stockouts, optimize inventory allocation, and improve order fulfillment accuracy. The also indicated that cement manufacturing firms should utilize automated storage and retrieval systems (ASRS), conveyor belts, and barcode scanning to eliminate manual data entry, reduce errors, and increase efficiency. They should also implement standard operating procedures and data sharing platforms to ensure accurate updates and collaboration between stakeholders in the distribution chain.

Correlations Analysis

Correlation analysis is a statistical technique used to measure the strength and direction of the relationship between two or more variables. Pearson correlation coefficient (r) ranges from -1 to 1. The results of correlation analysis were as presented in Table 4.3.

Table 4. 3: Correlation Coefficients

		Performance of Cement Manufacturing Firms	**Quality Management**	**Distribution Management**
Performance of Cement Manufacturing Firms	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	67		
Quality Management	Pearson Correlation	.832**	1	
	Sig. (2-tailed)	.000		
	N	67	67	
Distribution Management	Pearson Correlation	.801**	.023	1
	Sig. (2-tailed)	.000	.853	
	N	67	67	67

From the results, quality management had a strong and positive relationship with the performance of cement manufacturing firms in Machakos County, Kenya (r=0.832, p-value=0.000). The findings agree with Pambreni and Tham (2019) findings that quality management has an effect on organization performance of Small and Medium Enterprises (SMEs) in the service sector of Selangor, Malaysia. The findings also agree with Saadia (2021) findings that quality management has a significant relationship with firm performance.

Also, distribution management had a strong and positive relationship with the performance of cement manufacturing firms in Machakos County, Kenya (r=0.801, p-value=0.000). The findings are in agreement with Kiplagat (2019) findings that distribution management has a relationship with performance of manufacturing firms in Kenya. Also, the findings concur with Obiero (2019) observation that distribution has a positive relationship with performance of small and medium-sized enterprises in Kericho County.

Regression Analysis

Linear regression analysis was used to assess the weight of the effect of lean supply chain management practices on performance of cement manufacturing firms in Machakos County, Kenya. Lean supply chain management practices included quality management and distribution management.

The R-squared (coefficient of determination) is a statistical measure that provides insight into the goodness of fit of a regression model. It assesses the proportion of the variance in the dependent variable that is explained by the independent variables in the model. The results of the r-squared were as shown in Table 4.4.

Table 4.4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.854[a]	0.709	0.684	0.14013

a. Predictors: (Constant), Distribution Management, Quality Management

The R^2 value for the relationship between the independent variables and the dependent variable was 0.709, which means that approximately 70.9% of the variability in the dependent variable (performance) can be explained by the independent variables (distribution management & quality management) included in the model. In other words, the model accounts for a substantial portion of the variance in the performance of cement manufacturing firms in Machakos County.

Table 4. 5: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.345	2	6.173	32.49	.000[b]
	Residual	1.217	64	.0190		
	Total	13.563	66			

a. Dependent Variable: Performance of Cement Manufacturing Firms in Machakos County, Kenya

b. Predictors: (Constant), Distribution Management, Quality Management

Analysis of Variance (ANOVA) was used to show whether the regression model as a whole is statistically significant in explaining the variability in the dependent variable. The F-calculated (157.178), was lower the F-critical (2.46) from F-distribution table. In addition, the p-value associated with the F-statistic was 0.000, which indicates that the overall model is statistically significant. Therefore, regression model can be used in explaining the effect of distribution management, and quality management on the performance of cement manufacturing firms.

Table 4.6: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.748	0.159		4.704	0.000
	Quality Management	0.473	0.126	0.413	3.754	0.004
	Distribution Management	0.389	0.117	0.354	3.325	0.018

a. Dependent Variable: Performance of Cement Manufacturing Firms

Using the unstandardized coefficients, the regression equation was as follows;

$Y=0.748 + 0.473X_1 + 0.389X_2 + \varepsilon$

The results show that quality management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya (β_1=0.473, p-value=0.004). This indicates that a one-unit increase in Quality Management is associated with a 0.473 increase in performance. This p-value is below 0.05, again indicating a statistically significant relationship. The findings are in agreement with Gambi and Lizarelli (2020) findings that quality management practices have a significant effect on innovation in Brazilian manufacturing companies. The findings also concur with Muiruri and Peterson (2020) argument that quality management practices have a significant effect on competitiveness of manufacturing firms in Nairobi County.

Also, the results indicate that distribution management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya (β_2=0.389, p-value=0.018). As such, a one-unit increase in distribution management is associated with a 0.389 increase in performance. This p-value is below 0.05, again indicating a statistically significant relationship. The findings concur with Mbithe and Charles (2021) argument that distribution management strategies have a significant effect on the performance of cement manufacturing firms in Machakos County. The findings are also in line with Obiero (2019) findings that distribution management has a significant effect on the performance of small and medium-sized enterprises in Kericho County.

Conclusions

The study concludes that quality management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya. The study found that quality management in terms of quality planning, quality assurance and quality control have an effect on performance of cement manufacturing firms in Machakos County, Kenya. This implies that an improvement quality management would lead to an improvement in performance of cement manufacturing firms in Machakos County, Kenya.

The study concludes that distribution management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya. The study established that distribution management in terms of order processing, order fulfillment and order tracking have an effect on performance of cement manufacturing firms in Machakos County, Kenya. This implies that an improvement in distribution management would lead to an improvement in the performance of cement manufacturing firms in Machakos County.

Recommendations

The study found that quality management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya. The study recommends regular training programs for updating employees on changes in quality assurance procedures. In addition, cement manufacturing firms should establish strict quality control measures for incoming raw materials; work closely with suppliers to ensure consistent quality and explore alternative sources; and invest in technology for real-time monitoring of raw material variations. The study also recommends that cement manufacturing firms should implement advanced process control systems to optimize and regulate manufacturing processes; conduct regular process audits to identify and address inefficiencies; and invest in research and development for process improvements.

The study found that distribution management had a positive and significant effect on performance of cement manufacturing firms in Machakos County, Kenya. As such, the study recommends that the management of cement manufacturing firms should implement a real-time distribution management system. They should gain real-time visibility across warehouses and distribution channels to prevent stockouts, optimize inventory allocation, and improve order fulfillment accuracy. In addition, cement manufacturing firms should utilize automated storage and retrieval systems (ASRS), conveyor belts, and barcode scanning to eliminate manual data entry, reduce errors, and increase efficiency. They should also implement standard operating procedures and data sharing platforms to ensure accurate updates and collaboration between stakeholders in the distribution chain.

REFERENCES

Abimbola, B. O., Ekpudu, J. E., & Kuye, O. L. (2021). Contributions and theoretical approach to total quality management. *UNILAG Journal of Business*, *7*(2), 1-13.

Ahmed, S. (2019). Integrating DMAIC approach of Lean Six Sigma and theory of constraints toward quality improvement in healthcare. *Reviews on environmental health*, *34*(4), 427-434.

Anisere-Hameed, R. A., & Bodunde, T. D. (2021). The impact of inventory management on the profitability of manufacturing companies in Nigeria. *International Journal of Innovative Research and Advanced Studies (IJIRAS)*, *8*(1), 9-15.

Craighead, C. W., Ketchen Jr, D. J., & Darby, J. L. (2020). Pandemics and supply chain management research: toward a theoretical toolbox. *Decision Sciences*, *51*(4), 838-866.

Creswell, W. & Creswell, D. (2022). *Research design: Qualitative, quantitative, and mixed methods approaches.* New York: SAGE Publications, Inc.

Cutolo, D., & Kenney, M. (2021). Platform-dependent entrepreneurs: Power asymmetries, risks, and strategies in the platform economy. *Academy of Management Perspectives*, *35*(4), 584-605.

Devi, P. S. (2019). *Research methodology: A handbook for beginners.* New Delhi: Notion Press.

Duan, Y., & Huo, J. (2021). On empirically estimating bullwhip effects: Measurement, aggregation, and impact. *Journal of Operations Management*, *67*(1), 5-30.

Gambi, L. D. N. & Lizarelli, F. L. (2020). The impact of quality management practices on innovation: an empirical research study of Brazilian manufacturing companies. *Benchmarking: An International Journal*, *28*(3), 1059-1082.

Goh, M., & Goh, Y. M. (2019). Lean production theory-based simulation of modular construction processes. *Automation in Construction*, *101*, 227-244.

Gołaś, Z. (2020). The effect of inventory management on profitability: Evidence from the Polish food industry: Case study. *Agricultural Economics*, *66*(5), 234-242.

Hair, J.O., Page, M. & Brunsveld, N. (2020). *Essentials of Business Research Methods.* London: Routledge

Karuga, C. & kibe, L. W. (2023). Influence of Structural Decisions Strategy on Organizational Performance of Cement Manufacturing Firms in Kenya. *International Journal of Strategic Management, 2*(1), 22-37.

Kenya Association of Manufacturers (2022). *Cement Manufacturing Firms in Kenya*. Retrieved from https://kam.co.ke

Kimari, H. & Muli, S. (2022). The Influence of lean supply chain management practices on performance of manufacturing firms in Kenya. *International Journal of Business and Social Research, 12*(1), 1-15.

Kinyua, I. W., & Sije, A. (2023). Strategic Quality Management Practices and Operational Performance of Soft Drink Manufacturing Firms in Nairobi County, Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME), 7*(1), 101-122.

Kiplagat, N. K. (2019). *Role of Multi-Echelon Distribution Systems on Performance of Manufacturing Firms in Kenya* (Doctoral dissertation, JKUAT-COHRED).

Kitainge, J.M. & Jemaiyo, B. (2022). Distribution Channel Structure Influence on the Performance of Cement Manufacturing Firms in Kenya. *European Journal of Management and Marketing Studies*, *1*(2), 101-123.

Krishna, B. (2020). *Guide to Research Methodology and Biostatistics*. New York: SAGE Publications Ltd.

Mbithe, S., & Charles, N. (2021). Influence of Distribution Management Strategies on the Performance of Cement Manufacturing Firms in Machakos County; Kenya. *International Research Journal of Business and Strategic Management, 2*(2), 111-128.

Muiruri, J. W., & Peterson, M. O. (2020). Quality Management Practices and Competitiveness of Manufacturing Firms in Nairobi. *International Journal of Supply Chain and Logistics*, *4*(1), 27-45.

Mukherjee, S.P. (2020). A Guide to Research Methodology: An Overview of Research Problems, Tasks and Methods. New York: CRC Press.

Mulandi, C. M., & Ismail, N. (2019). Effect of inventory management practices on performance of commercial state corporations in Kenya. *International Academic Journal of Procurement and Supply Chain Management*, *3*(1), 180-197.

Ochieng, B. (2021). Lean Manufacturing Practices and Supply Chain Performance of Sugar Manufacturing Firms in Western Kenya. American Journal of Supply Chain Management, 6(1), 27 - 43. https://doi.org/10.47672/ajscm.719

Oluwakoya, A. O., & Ogundipe, S. D. (2022). Investigating the Influence of Third-Party Logistics Providers on the Physical Distribution of Manufactured Products. A Study of MDS Logistics. *Journal of Behavioural Studies*, *3*(2).

Ongaro, F.J. (2019). *Effect of Lean Manufacturing Practices on Supply Chain Performance of Manufacturing Firms in Kenya: A Case of Food Manufacturing Firms in Nairobi County*. Retrieved from https://repository.kcau.ac.ke/

Panigrahi, R. R. & Sahoo, A. (2021). Inventory management and performance of manufacturing firms. *International Journal of Value Chain Management*, *12*(2), 149-170.

Rajab, F., Ngugi, P., & Kiarie, D. (2021). Influence of supplier relationship management on performance of manufacturing firms in Kenya. *International Journal of Supply Chain and Logistics*, *5*(1), 31-45.

Taengwa Denhere, E., & Choga, F. (2022). Effect of Supplier Relationship Management on Organizational Performance: A Case Study of the Plastic Manufacturing Industry in Harare between 2015-2019. *Open Journal for Information Technology*, *5*(1), 17.

Tiwari, P., Sadeghi, J. K., & Eseonu, C. (2020). A sustainable lean production framework with a case implementation: Practice-based view theory. *Journal of Cleaner Production*, *277*, 123078.

Udeze, C. & Ugbam, O. (2018). Effect of Lean Manufacturing on the Performance of Nigerian Manufacturing Organization. *Aefunai Journal of Accounting, Business and Finance, 2*(12), 101-112.

Wachuma, P. & Shalle, N. (2020). Effect of Lean Supply Chain Management Practices on Organizational Performance in Government Ministries in Kenya: A Case of Children's Department in the MLSSS. *International Journal of Academic Research in Business and Social Sciences, 6*(5), 364-375.

Zhu, T. & Balakrishnan, J. (2020). Bullwhip effect in the oil and gas supply chain: A multiple-case study. *International journal of production economics, 224*, 107548.