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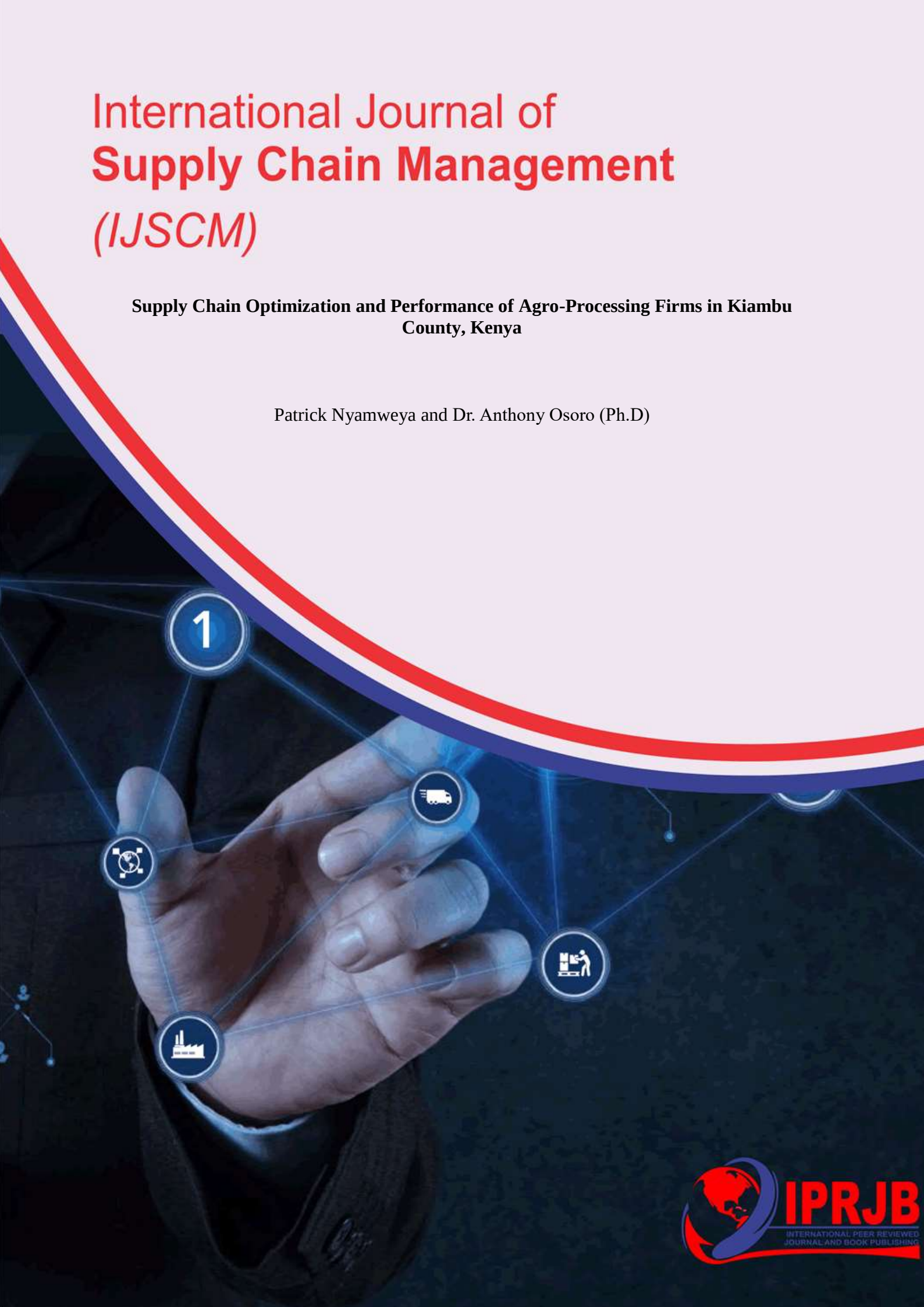

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# Supply Chain Optimization and Performance of Agro-Processing Firms in Kiambu County, Kenya

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**Abstract**

**Purpose:** The purpose of the study was to establish the relationship between supply chain optimization and performance of agro-processing firms in Kiambu County, Kenya.

**Methodology:** The study used descriptive research design, where both qualitative and quantitative research was applied. The target population was 240 respondents from the concerned departments in Kiambu County, Kenya. The researcher carried census survey since respondents are manageable. The research technique was purposive random sampling techniques with different stratus. 10% (24) of the respondents were pilot tested for validity and reliability of the research instrument. Data was analyzed using descriptive statistics and inferential statistics with the help of Statistical Package for Social Science version 28 and the same was now presented in a form of tables and figures. The pilot and validity test results was over 0.7 and 0.5 respectively. The research proceeded to actual data collection with few adjustments of research questionnaire. Data was presented in form of tables.

**Findings:** The study findings indicate that Supply Chain optimization has a broad impact on performance of agro-processing firms in Kiambu County, Kenya. The study revealed that there is a positive relationship between inventory optimization and performance of agro-processing firms, sustainability optimization influences performance of agro-processing firms, demand forecasting had a positive effect on performance of agro-processing firms and there is a positive relationship between reduced cost optimization and performance of agro-processing firms in Kiambu County, Kenya.

**Unique Contribution to Theory, Practice and Policy:** This study was anchored on inventory theory. The study's recommendation to all firms is that the implementation of supply chain optimization and performance of agro-processing firms in Kiambu County, Kenya was a significant relationship. This study recommends that the best performance of agro-processing firms in Kiambu County, Kenya should strive to be proactive on how to perform better to retain integrity and improve transparency and accountability on performance of agro-processing firms in Kiambu County.

**Keywords:** *Supply Chain, Optimization, Performance, Agro-Processing Firms*

## INTRODUCTION

Supply chain management is one of the most essential aspects of conducting business. Many people outside of the direct community (in research and industry) do not realize this because an ordinary consumer often experiences only its effects. Recall the times when the item that you wanted was not available in your favorite garments or grocery store, recall how many times you got a great 'deal' at the end of the season, recall the sudden increases in gas prices due to shortages, recall the times when your e-commerce site promised availability but later could not send the required product or sent you the wrong product, or recall the times when your customized product (like a personal computer or kitchen cabinet) was delayed to a great extent (Vincent, 2019). All the above and several other experiences that consumers have on a routine basis are direct consequences of supply chain practices followed by firms. As opposed to business-to-consumer transactions, supply chain practices have immediate impact on business-to-business transactions.

Supply chain optimization concerns the improvement of the performance and efficiency of the manufacturing and distribution supply chain by making the best use of resources. In the context of supply chain optimization, scheduling has always been a challenging task for experts, especially when considering a distributed manufacturing system (DMS) (Meng et al., 2015). The present study aims to tackle the supply chain scheduling problem in a DMS while considering two essential sustainability aspects, namely environmental and economic. The economic aspect is addressed by optimizing the total delivery time of order, transportation cost, and production cost while optimizing environmental pollution and the quality of products contribute to the environmental. Supply Chain Optimization aims to capture a segment of recent research activity in supply chain management (Pratama et al., 2017).

The availability of a planning and optimization methodology for supply chains operating under any prevailing conditions of uncertainty would therefore be tantamount to being able to deliver 'realistic' and planned supply chain operating solutions since all prevailing conditions of operational uncertainty would be accommodated (Fan & Xia, 2017). A supply chain is a group of organizations (including product design, procurement, manufacturing, and distribution) that are working together to profitably provide the right product or service to the right customer at the right time. Supply Chain Management (SCM) is the study of strategies and methodologies that enable these organizations to meet their objectives effectively. In the past few decades, people have realized that cooperation with other organizations in the supply chain can lead to significantly higher profits. As a result, industrial supplier customer relations have undergone radical changes resulting in a certain level of co-operation, mainly in the area of information sharing, that was lacking before. The degree of co-operation varies significantly from one supply chain to another. The information sharing could range from generic such as type of inventory control policy being used, type of production scheduling rules being used to specific such as day-to-day inventory levels, exact production schedules (Li & Wang, 2019).

A supply chain is a set of firms linked by one or more upward and downward streams of goods and services, cash flow and information from end to end. On the other hand supply chain management is the strategic coordination of traditional business functions within and without organizations with the intent of enhancing performance. According to Fan & Xia (2017) supply chain optimization refers to the science and art of designing a comprehensive qualitative and quantitative strategic view of the entire organization's supply chain. By analyzing supply chain networks, organizations will be in a position to bring to the fore different quantitative matrices

regarding various aspects of the supply chain that will make the network function optimally (Li & Wang, 2019).

Some examples of previous supply chain, under uncertainty, research works, in this regard). Other examples of related supply chain under uncertainty research work include Optimization of Production-Distribution Systems under Uncertainty. Optimization of Delivery Systems under Uncertainty, and Optimization of Decentralized Supply Chains. This research area focuses on applying optimization techniques to supply chain management problems. While the general area of supply chain management research is broader than this scope, our intent is to compile a set of research papers that capture the use of state-of-the-art optimization methods within the field (Liu & Huang, 2017). Several researchers who initially expressed interest in contributing to this effort also expressed concerns that their work might not contain a sufficient degree of optimization. Others were uncertain as to whether the problems they proposed covered a broad enough scope in order to be considered as supply chain research (Portney, 2015). Our position has been that research that rigorously models elements of supply chain operations with a goal of improving supply chain performance (or the performance of some segment thereof) would fit under the umbrella of supply chain optimization. We therefore sought high-quality works from leading researchers in the field that fit within this general scope. We are quite pleased with the result, which has brought together a diverse blend of research topics and novel modeling and solution approaches for difficult classes of supply chain operations, planning, and design problems (Mostavi, 2017).

In these two cases, expressions such as Fuzzy Optimization, Stochastic Optimization and Stochastic Fuzzy Optimization were coined to describe the procedures involved in determining the best operating solutions under those uncertain operating conditions (Li & Wang, 2019). To add to the confusion, the planning term, 'Multi-Objectivity was occasionally added to these expressions whenever there was a planning requirement to consider multiple supply chain objectives, be they maxima, minima or a combination of both in nature, in solutions for uncertain supply chain operations, Multi-Objective-Fuzzy Optimization, Multi-Objective-Stochastic Optimization and Multi-Objective-Stochastic-Fuzzy Optimization. A supply chain optimization capability that could cater for any prevailing conditions of operational uncertainty and that could also cater for any desired number of performance objectives would be of great interest to the commercial industrialized world where various combinational instances of operational uncertainty and corresponding planning requirements frequently occur. A good example of this is ammonia, (NH3), from coal production and also the downstream production of fertilizer and explosives. Operational uncertainty is manifest in many ways (Longo Francesco Montana & Sanseverino, 2019).

**Inventory Optimization**

Inventory optimization techniques can help you: Boost Profitability: Gain real-time insight into inventory levels, order status, and ownership to enhance customer satisfaction, expand quality initiatives, and improve performance throughout the sales process; Lower Costs: Realize the potential for a significant increase in labor productivity, lower operating costs, near-perfect order fulfillment, and reduced inventory levels in the warehouse which can help make your business more competitive; Improve Quality: Getting things right the first time drives quality excellence and reduces your inventory investment by avoiding unnecessary reorders caused by inaccurate knowledge of what's already on hand (Dhunny et al., 2019). Improve performance through the use of data, information, and knowledge to understand variability and to improve

strategic and operational decision making; Focus on Continuous Performance Improvement: Better performance using benchmarking and best practices, as you measure the right metrics to achieve your corporate objectives; Offer Competitive Guarantees: With a better understanding of your inventory, you can offer lowest price or fastest shipping guarantees. Understand what markets and customers value, now and into the future, and use this to drive organizational design, strategy, products, and services (Okumu & Bett, 2019).

Inventory is the largest single asset that most companies need to manage. Unfortunately, it consumes space, gets damaged, and sometimes becomes obsolete or expires, and carrying surplus inventory unnecessarily costs the organization. Inventory needs to be purchased, stored, and maintained and ties up cash (Dhunny et al., 2019). This working capital can be a significant burden for many companies and if freed up can provide significant cash resources that can be used to pursue revenue-generating opportunities and strategic investments. The well-documented benefits of running a manufacturing, distribution, service, or retail operation with leaner inventory range from a permanent reduction in working capital to higher productivity to better customer service levels. As Forrester Research pointed out in a recent report, the ability to increase inventory turns is a key differentiator between highly successful and more poorly performing companies (Okumu & Bett, 2019).

**Demand Forecasting**

Demand planning and forecasting are a set of business processes that involve predicting future demand and aligning procurement, production, and distribution capabilities to meet that forecast. Involving a number of different business functions, this requires the sharing of timely data, the accurate processing of that data, and agreement on joint business plans, as defined in the S&OP (Dhunny et al., 2019). Accurate and timely demand and forecast plans are one of the most important components of an effective supply chain and inventory optimization. Best practices in delivering real-time demand-led supply chains require collaboration, flexibility in responsiveness, and robust cross-functional business planning. Companies must take a more systematic approach to demand planning and forecasting and strive for deeper collaborative supply chain practices both within organizations and with trading partners. Developing collaborative supply chain practices will drive demand planning accuracy, which in turn optimizes service levels, while reducing inventory. Depending upon the size of your inventory, this can be achieved through inventory management techniques and reporting or with specialized tools that encourage supply chain visibility (Ongeri & Osoro, 2021).

Demand Forecasting; when dealing with independent demand, forecasting is an important step for the best estimation and prediction of possible changes in the future replenishment (Dhunny et al., 2019). Forecasting also aims to minimize the inaccuracy based on the previous forecasts. Demand forecasting can be either easy or hard, depending on the type of products, stability of demand and the length of the time period. Time Series Methods: These methods involve looking at the pattern of the past demand and extending this into the future, in other words, predicting the future based on the past data. Accuracy of forecast: refers to the actual demand versus demand forecasted in a period (Ongeri & Osoro, 2021).

**Sustainability Optimization**

The definition of the United Nations Brundtland Commission on sustainability has become more dynamic than others. We call sustainability the technology that meets today's needs without jeopardizing the future generations' ability to meet their own needs. Therefore,

sustainability is a multidisciplinary concept, based on this understanding that covers different aspects of life. Clearly, sustainability is a concept in the core of the planet that focuses on the condition and depletion of the biophysical environment of Earth. In 2015, the General Assembly adopted the 2030 Agenda for sustainable development (Dhunny et al., 2019). They adopted the Agenda for its action to combat poverty, protect the planet, and enhance everybody's lives and opportunities. This paper focuses on reviewing trends and recent research papers in sustainability and energy efficiency (Goals 7 and 12) and sustainable building design problems out of 17 sustainable development goals. Optimization is one of the most important tools for achieving sustainability. Optimization is a search process for a specific problem according to special conditions of that problem. In fact, optimization refers to finding processes of optimal values for a given network parameter, using all feasible values for the minimization or maximization of network output. The goal of optimization is to discover the best feasible response with the consideration of the problem constraints (Ongeri & Osoro, 2021).

The presence of complex scientific and engineering problems calls for using optimization methods to solve the desired problem. Due to the time consuming and complexity of exact methods, utilizing intelligent optimization algorithms has crucial importance (Dhunny et al., 2019). Optimization of many complex scientific problems which require solutions with accurate computations and appropriate time cannot use classical methodologies. In this regard, nature can be considered as a rich source which, like a powerful mechanism, provides principles and concepts in order to design artificial computational methods for solving complex optimization problems. Metaheuristic optimization algorithms, which are also called smart and modern optimization algorithms, are categorized as stochastic optimization algorithms employed for finding optimal solutions. The word "metaheuristic" was first adopted by Glover when introducing TS as a novel heuristic method. Heuristic optimization methods are a set of algorithms for optimization of problems which search solution space to find optimal response randomly but purposeful and simple (Ongeri & Osoro, 2021).

**Reduced Cost Optimization**

The advantages of cost control are mainly as follows: Cost control helps to achieve expected return on the capital invested in a company, by resolving deviations between actual and expected standards (Dincer & Zamfirescu, 2018). Cost control leads to improved standards of production with the limited resources of the company. Cost control reduces the prices or tries to maintain it by reducing the cost. Cost control leads to economic use of resources. It increases profitability and competitive position of a company. It enhances credit worthiness of the company. It prospers and increases economic stability of the industry. It increases the sales of the company and maintains the level of employment. Disadvantages of Cost Control (Ongeri & Osoro, 2021).

The disadvantages of cost control are mainly as follows: It reduces the flexibility and process improvement in a company. It restricts innovation by emphasizing to reaching the preset standards. It requires skilled personnel to set standards. It lacks creativity as it is concerned with following the current standards (Dincer & Zamfirescu, 2018). It does not lead to improvement in standards; Techniques of Cost Control Budgetary control: The budgetary control is process of continuous comparison. It works with creating budgets and continuous comparison of these budgets with the actual. It is finding the reasons for deviations and revising the budgets with needs. It helps in planning coordination and controlling. 2. Standard costing:

Standard costing is setting a standard cost and using this standard cost with actual and analyze the variances. It helps in identifying the causes of variances and cost estimation. 3. Inventory control: Inventory control is regulating purchase, and usage of material to maintain the production without blocking the extra funds into it. It tries to reduce the wastage of the material and leads to effective utilization of it (Ongeri & Osoro, 2021).

**Performance of Agro-Processing Firms**

The agro-processing industry is regulated by: the Ministry of agriculture, which sets the policies and strategies for development of the agriculture sector and sets the policies and strategies for the livestock and fishery industries; Kenya dairy board which regulates the dairy industry and licenses dairy products processors; (Dincer & Zamfirescu, 2018). Department of veterinary Services, a veterinary regulatory management and quality control of inputs, livestock, livestock products and by-products; and the Kenya sugar board, which licenses sugar importation and coordinates the sugar growing industry. The contribution of the agro-processing industry to GDP in millions of Kenya shillings and contribution to wage employment in terms of the total number of people employed by the industry for the period 2011-2013 (Ongeri & Osoro, 2021).

The agricultural sector plays a critical role in the overall economic growth of the Ghanaian economy (Dincer & Zamfirescu, 2018). Indeed, agriculture is expected to lead to a significant transformation of the economy through improvements in the sector's productivity. The sector is divided into a number of subsectors: crops, cocoa, livestock, forestry, and fisheries. The crop subsector contributes about 66.2 per cent to the sector, with a large percentage of its products undergoing some form of processing. The major products include cocoa, cashew, sunflower, oil palm, groundnut, fruits, and vegetables, among others. The most common item that is processed is maize, followed by other commodities such as nuts and oils, fish, and grains such as millet, sorghum, and guinea corn (Ongeri & Osoro, 2021).

**Statement of the Problem**

Most organizations spend more than 60% of their income dollars on purchasing goods and services. It is even possible that about 40% of an organization's purchases constitute 80% of the total purchase value (Goudarzi et al., 2018). The agro-processing firms demands have grown tremendously and has lest into liberalization of provision of processing firms to its farmers, hence the need to adopt to supply chain optimization. Agro-processing firms facilities have stepped in to bridge the gap that firms through supply chain optimization has left (Fan & Xia, 2017). Application of technology in procurement is one of the hot areas of optimizing costs up to 30% and a strategic upgrade from the manual procurement systems (Fan & Xia, 2017). According to Jawahar et al. (2017) "supply chain optimization plays a key role that helps reduce the operation costs, increase efficiency and significantly reduce lead times. Agro-processing firms providers like other organizations have embraced supply chain optimization to take advantage of the accruing benefits.

Despite the benefits that supply chain optimization generates literature provides that performance in delivery of agro-processing firms to the stakeholders and public has taken a dip. Challenges in procurement processes have significantly strained the availability of the necessary supplies for agro-processing operations (Fan & Xia, 2017). There are reported supply chain optimization, demand forecasting, reduced cost optimization, invoicing that derail the entire procurement process. The significant number of complaints that firms are blamed for in

the procurement process varies (Goudarzi et al., 2018). The inconveniences caused by inefficient procurement process in the supply chain optimization explain "the farmers due to delays from upstream supply chain and poor access to agro-processing firms" (Ongeri & Osoro, 2021). These concerns peg the question on the role of supply chain optimization in the provision of farmers to the public. It's in the foregoing that this study seeks to examine the effect of implementation of supply chain optimization on performance of agro-processing firms in Kiambu County, Kenya. Therefore it's assumed it will bridge the existing knowledge gap with the new research findings out of this study.

## LITERATURE REVIEW

### Theoretical Framework

### Inventory Theory

In order for this type of inventory policy to be successful, Zappone and his employees communicate often. He checks the level of his inventory and the price of copper daily, and discusses pending sales with his sales crew. All in all, the mathematical models in this paper cannot help Zappone's company. Because the price of copper fluctuates so much from day to day, it is hard to say when exactly to order (Bratton, 2003). Perhaps, with more studying and a more complex model, we could formulate an optimal policy for Zappone. This would require more complex statistical analysis in order to deal with the fluctuating price of copper. Another reason we would need a more in depth model is that although Zappone orders the copper today, at today's prices, he will be charged the price of copper on the day it ships, roughly 5 weeks later. Even though he does not use a model, Zappone has done well for himself. He sells copper all over the world: Japan, South America, Europe, and all 50 states. In addition, he is environmentally friendly because about 80% of the copper he uses comes from recycled copper and only 20% comes from new copper being mined from the ground. However, the price of copper, whether it is reusable or new, does not differ, so this does not change his inventory policies. This shows that an inventory model is helpful but not necessary for all companies (Carver, 1996).

In this research, we began the study of inventory theory. We examined two types' models: deterministic continuous review models and stochastic models. In addition, inventory theory 15 we learned about quantity discounts and how these affected our models. We also looked at a few examples of how these models are used (Bratton, 2003). However, this paper only touches the surface of what inventory theory is all about. After learning the basics, we now can ask and study more complex questions. For example, what happens when customers place orders in advance for a future delivery? A company could choose to allow for four different levels of response time to customers: standard (five-day delivery), value (slower, but lower shipping cost), premium (faster, next day delivery), and precision (delivered on a specific date). How does this hypothetical company handle its inventory policy? If interested in the previous question. Another problem we can consider deals with a firm that supplies goods to two different types of customers: customers who have long-term supply contracts, and customers who request goods occasionally. The orders of the customers who have supply contracts are known in advance and must be fully met without delay every period. However, the unexpected requests from occasional customers are unknown and the company can either accept the order or reject it. How does a company deal with their inventory policy when it mixes deterministic and stochastic demand? If interested in this issue surrounding inventory theory (Becker, 1962).

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## Conceptual Framework

According to Zhang (2013), conceptual framework is a system of concepts, assumptions, perceptions, beliefs, and theories that underpins and informs research as a key component of the research design.

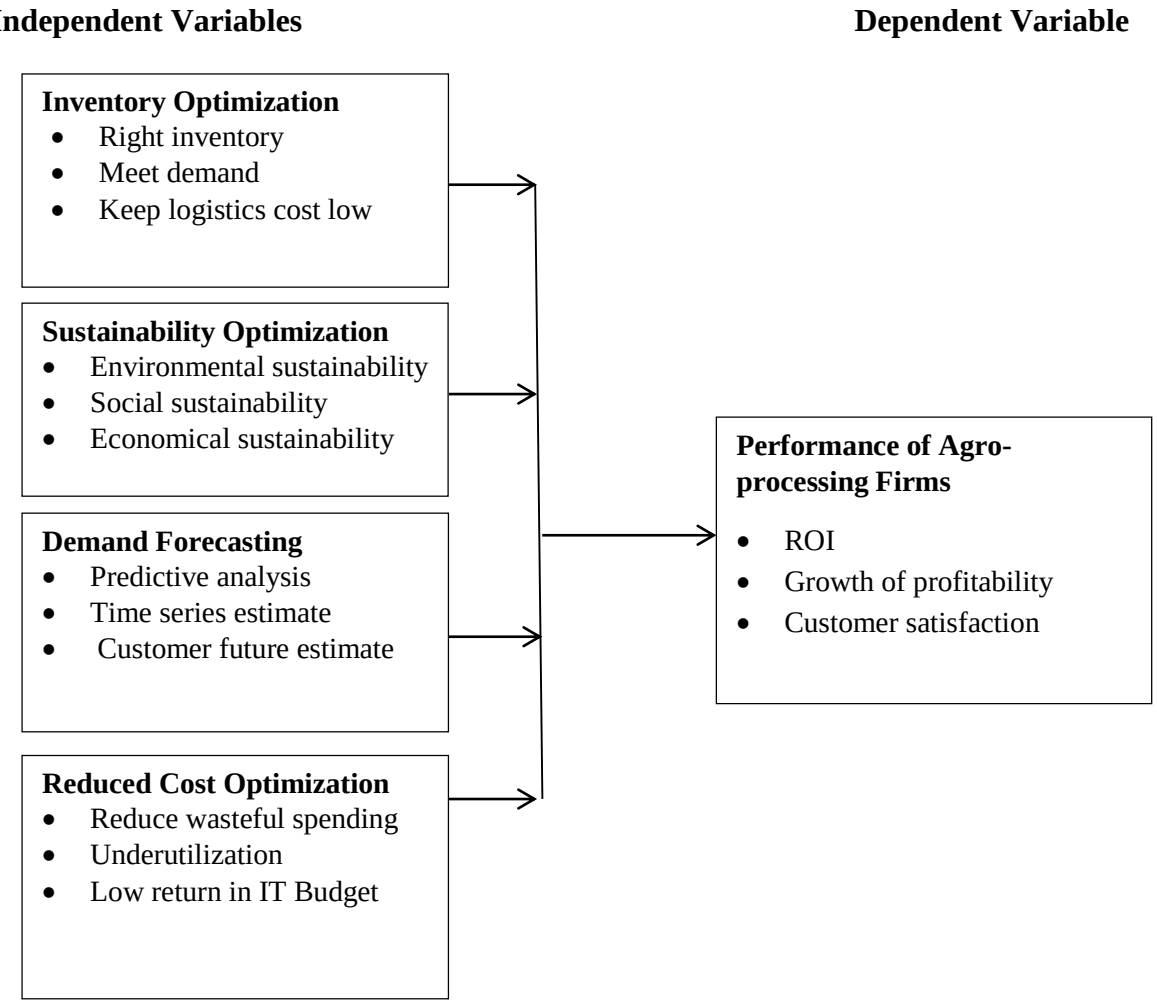


*Figure 1: Conceptual Framework*

## Research Gaps

The supply chain optimization is an on-going process that has not increased the effectiveness, quality and openness of agro-processing firms. According to Onegeri and Osoro (2021) Legal and legislative mechanisms that give rise to the regulations have not, in the future, addressed the issues facing the supply chain agility management. Also according to Okumu and Bett (2019) the mechanism of supply chain optimization also faces integrity challenges in decision-making and its implementation. Supply chain optimization should respond to the aspirations, perceptions and needs of agro-processing manufacturing firms. According to Ongeri and Osoro (2021), the performance of Agro-processing firms are experiencing myriad of obstacles through supply chain agility. Despite general and specific policies put in place by the Government of Ghana and aimed at promoting the agro-processing industry in the country, Kenyan produces a little over 30 per cent of the raw materials needed by agro-based industries

(Pratama,et al., 2017). Almost all the food products sold to local markets have very limited value addition. Cereals and grain legumes are often just threshed, while roots and tubers and plantains are sold predominantly in their raw form. A critical element of the modernization of the agriculture sector is value addition to primary produce. However, the lack of reliable statistics on the supply of and demand for processed agricultural products, constrains the effectiveness of this sector (Sarkar, Tayyab, Kim & Habib, 2019). In view of the foregoing, this study therefore aimed to bridge the existing gap by new knowledge out of this research findings.

## METHODOLOGY

The research adopted descriptive research design. target population was 240 respondents from the agro-processing firms in Kiambu County, Kenya; the head of procurement and head of finance, farm manager and administration officer from all agro-processing farms in the in Kiambu County, Kenya. This study used purposive random sampling techniques. Data was collected from the 240 respondents from procurement and finance office department in each of the agro-processing firms within the county. Data was collected using open and closed ended (structured) questionnaires. The completed questionnaires was edited for accuracy and completeness before being processed using Statistical Packages for Social Sciences (SPSS) version 28. Descriptive statistics such as means, frequencies, and percentages was used to analyze the quantitative data. Tables, figures, and charts was used to display the information.

## FINDINGS AND DISCUSSION

### Descriptive Statistics

Respondents were requested to give their opinion on the variable Inventory optimization. From Table 1, the respondents unanimously agreed that Inventory optimization ensured performance of agro-processing firms and periodic review in Kiambu County in Kenya viable with agreement of a mean was 3.742, and Standard Deviation of 1.0602; Through right inventory management in Kiambu County the respondents gave neutral response with a mean of 3.533 and Standard Deviation of.9202; meeting demand assessment has contribution to the quality and innovation of the inventory optimization with strongly agree a Mean of 3.903, and Standard Deviation of .9007; keeping logistics cost low in Inventory optimization it is important to put in place and maintain procurement the respondents gave a strongly agree with a Mean of 4.061, and Standard Deviation of .1895; The management of Kiambu County in Kenya implements performance of agro-processing firms award the respondents disagreed with a Mean of 3.541 and Standard Deviation of 1.3020); and Inventory optimization enhances performance of agro-processing firms at Kiambu County in Kenya, they agreed with a Mean of 3.566, Standard Deviation of .7017. These findings agrees with the findings of Nyile *et al.* (2022) who observed that clear description of Inventory optimization, enhance effective performance of agro-processing firms in Kiambu County, Kenya.

**Table 1: Inventory Optimization**

| Statement | Mean | Standard Deviation |
|---|---|---|
| Our firm, ensures right inventory information sharing through Real time basis | 3.374 | 1.0602 |
| Through meeting demand in Kiambu county, our firm has been able to make decisions on re-order times | 3.533 | .9202 |
| Responsiveness of keeping logistic low to performance of Kiambu County, Kenya | 3.903 | .9007 |
| By quick, frequent & accurate sustainability optimization, it is important to put in place Inventory optimization | 4.061 | .1895 |
| The management of supplier evaluation improves supply chain duration in inventory optimization | 3.541 | 1.302 |
| Inventory optimization enhances performance of Kiambu County, Kenya. | 3.566 | .8017 |

**Sustainability Optimization**

From Table 2, respondents agreed that: The Kiambu County in Kenya considers supply chain on Sustainability optimization with a mean of 3.551 and Standard Deviation of.8312; A environmental sustainability is likely to circulated based on supply chain period on performance of agro-processing firms in Kiambu County in Kenya agreed with a Mean of 4.033 and Standard Deviation of.18906; social sustainability application involvement on performance of agro-processing firms in Kiambu County in Kenya the respondents were neutral with a Mean of 4.041 and Standard Deviation of.7302); Through economic sustainability towards performance of agro-processing firms in Kiambu County in Kenya; the respondents strongly disagreed with a Mean of 4.111 and Standard Deviation of .7117; proper sustainability optimization and agro-processing firms access to bids in the earliest possible has improved performance of agro-processing firms in Kiambu County in Kenya, the agreed with a Mean of 4.094 and Standard Deviation of .8005; Online sustainability has enhances performance of agro-processing firms in Kiambu County in Kenya, the respondents gave a strongly agree with a Mean of 4.252 and Standard Deviation of .8165 . These findings was in agreement with the findings of Ongeri and Osoro (2021) that the goal of Supply chain proactive planning is to ensure performance of agro-processing firms in Kiambu County in Kenya. Effective Sustainability optimization minimizes or eliminates problems and potential claims and disputes. This results agrees with the finding of Ominde et al. (2022). It is essential for Sustainability optimization to understand the provisions of the supplier evaluation, have the ability to perform to all practices involved, and maintain control over the performance of agro-processing firms in Kiambu County.

**Table 2: Sustainability Optimization**

| Statement | Mean | Standard Deviation |
|---|---|---|
| Our firm considers predictive analysis on performance of agro-processing firms in Kiambu County, Kenya | 3.551 | .8312 |
| Environmental sustainability enhances performance of agro-processing firms in Kiambu County, Kenya | 4.033 | . 18906 |
| Social sustainability application involvement improves performance of agro-processing firms in Kiambu County, Kenya | 4.041 | .7302 |
| Economic Sustainability enhances performance of agro-processing firms in Kiambu County, Kenya | 4.061 | .7117 |
| Proper sustainability optimization and access to bids in the earliest possible has improved performance of agro-processing firms in Kiambu County, Kenya | 4.094 | .8005 |
| Online sustainability can boast procurement performance of agro-processing firms in Kiambu County, Kenya | 4.252 | .8165 |

**Demand Forecasting**

The findings presented in Table 3 show that respondents agree that: Network has effect on performance of agro-processing firms in Kiambu County in Kenya (M=3.505, SD=.18902); Demand forecasting criterion on performance of agro-processing firms in Kiambu County in Kenya city County, Kenya ; the respondents agreed with a Mean of 3.411 and Standard Deviation of .1893; predictive on analysis on performance of agro-processing firms Kiambu County in Kenya city County, Kenya they gave strongly agree with a Mean of 4.603, Standard Deviation of .18936; Demand forecasting is significant when you want performance of agro-processing firms in Kiambu County in Kenya; the gave strongly agree response with a mean of 4.603, Standard Deviation of .6909; time series estimate enhances on performance of agro-processing firms in Kiambu County in Kenya; the disagreed with a Mean of 3.596, Standard Deviation of .7024; and through customer future estimate of orders, the firms is able to identify problems and find solutions in a timely manner to ensure high quality of the goods and services delivered Strongly disagreed with a Mean of 4.011, Standard Deviation of .7045).

The findings concurs with the finding of Boit and Osoro (2021), who argued that it is critical to Demand forecasting frequently and at regular intervals after award to ensure that the supplier is providing the goods and services on schedule and within the procurement plan , and that quality standards are being met, especially for the highest-risk and most complex contracts. Evaluating post-award performance entails several activities to ensure that the delivery of services meets the terms of the contract. These include identifying performance criteria, such as key performance indicators, at the time of contract formulation, and providing adequate monitoring resources and a capable workforce for overseeing contractor evaluation, by so doing performance of agro-processing firms in Kiambu County in Kenya was improved.

**Table 3: Demand Forecasting**

| Statement | Mean | Standard Deviation |
|---|---|---|
| Maintaining Supply chain networks improves performance of agro-processing firms in Kiambu County, Kenya | 3.505 | .18902 |
| Demand forecasting improves performance of agro-processing firms in Kiambu County, Kenya | 3.411 | .1893 |
| Predictive Analysis activities enhances performance of agro-processing firms in Kiambu County, Kenya | 4.603 | .1894 |
| Stability of supplier can boast procurement performance of agro-processing firms in Kiambu County, Kenya | 4.603 | .6909 |
| Time series estimate enhances performance of agro-processing firms in Kiambu County, Kenya | 3.596 | .7024 |
| Correct Customer Future estimate of orders improves performance of agro-processing firms in Kiambu County, Kenya | 4.011 | .7045 |

**Reduced Cost Optimization**

From Table 4, respondents, respondents agreed that reduced cost optimization ensure performance of agro-processing firms Kiambu County in Kenya; the respondent gave a Mean of 4.039 and Standard Deviation of.7307; reduced wasteful spending on performance of agro-processing firms Kiambu County in Kenya , they gave strongly disagree with a Mean of 4.004 and Standard Deviation of .7307; Optimal utilization and contract award fairness on performance of all agro-processing firms in Kiambu County in Kenya; the gave strongly agree with a Mean of 4.207, Standard Deviation of .18907; In cases of low return in IT budget to embrace better performance of agro-processing firms in Kiambu County in Kenya they gave a Mean of 4.010 and Standard Deviation of .8073; Alternative value reaction process contributes to performance of agro-processing firms in Kiambu County in Kenya ;most of the respondents were neutral with a Mean of 3.926 and Standard Deviation of .7306; and to enhance dispute resolution results in agro-processing firms, our county has in recent time conducted supplier evaluation resolution towards performance of agro-processing firms in Kiambu County in Kenya; they gave a Mean of 4.105 and Standard Deviation of .7055.

These findings are in line with the findings of Nyile *et al.* (2022) who observed that the characteristic of Reduced cost optimization are the best value reaction to sort out non-performance of, after Reduced cost optimization, for resolving return on investment. The problem areas giving rise to disputes are mainly related to Kiambu County's matters.

**Table 4: Reduced cost optimization**

| Statement | Mean | Standard Deviation |
|---|---|---|
| Reduced cost optimization techniques enhances performance of agro-processing firms in Kiambu County, Kenya | 4.039 | .7307 |
| Our firm embraces reduced wasteful spending to improve performance of agro-processing firms in Kiambu County, Kenya | 4.004 | .7307 |
| Optimal utilization and contract award fairness enhances performance of agro-processing firms in Kiambu County, Kenya | 4.207 | .18907 |
| Low return in IT budget on performance of agro-processing firms in Kiambu County, Kenya | 4.010 | .8073 |
| Alternative value reaction process contributes to performance of agro-processing firms in Kiambu County, Kenya | 3.926 | .7306 |
| Supplier evaluation and Dispute resolution improves performance of agro-processing firms in Kiambu County, Kenya | 4.105 | .7055 |

**Performance of Agro-Processing Firms in Kiambu County**

Respondents gave their level of agreement on various statements relating with performance of agro-processing firms in Kiambu County, Kenya. The results were as presented in Table 5 below:

From the findings, respondents were in agreement that performance of agro-processing firms in Kiambu County in Kenya is being affect by supplier relationship management, they gave 63.2%; when asked about Value for money and its effect on procurement performance of agro-processing firms in Kiambu County in Kenya they gave strongly agree of 70.7 %; When the respondents were asked to show their level of agreement on how return on investments affects performance of agro-processing firms in Kiambu County in Kenya they gave strongly disagreed of 9%; When also the respondents were asked to show their level of agreement on growth of profitability in Kenya government on performance of agro-processing firms in Kiambu County in Kenya they gave They gave agreed of 69.7%; Alternative supply chain optimization process contributes to Demand forecasting on performance of agro-processing firms in Kiambu County in Kenya they gave neutral of 42.5% and through customer satisfaction, operational performance measured by quality, flexibility, Demand forecasting on procurement performance of agro-processing firms in Kiambu County in Kenya they gave disagreed of 74.2%. The outcome is in line with the findings of Mutai and Osoro (2021) they observed that some of the factors that contribute to inefficiency in public procurement as corruption, delayed payments, poor planning, statutory amendments, insufficient use supplier evaluation low public participation, and improper payment procedures negatively affects performance of agro-processing firms Kiambu County in Kenya in Kenya.

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**Table 5: Performance of Agro-processing firms in Kiambu County**

| Statement | Yes (%) | No (%) |
|---|---|---|
| Supplier relationship management affects performance of agro-processing firms in Kiambu County, Kenya | 63.2 | 36.8 |
| Value for money and No. of agro-processing firms can affects their performance in Kiambu County, Kenya | 70.7 | 29.3 |
| Return on investments can affect performance of agro-processing firms in Kiambu County, Kenya | 91.0 | 9.0 |
| Growth of profitability in Kenya government can affect performance of agro-processing firms in Kiambu County, Kenya | 69.7 | 30.3 |
| Alternative supply chain optimization processes in Demand forecasting can affect performance of agro-processing firms in Kiambu County, Kenya | 42.5 | 57.5 |
| Customer Satisfaction, operational performance measured by quality, flexibility, Demand forecasting, can affect performance of agro-processing firms in Kiambu County, Kenya | 74.2 | 25.8 |

## Pearson Correlation Analysis

The study further conducted inferential statistics entailing both Pearson and regression analysis with a view to determine both the nature and respective strengths of associations between the conceptualized predictors such as Inventory optimization, Sustainability optimization ,Demand forecasting and Reduced cost optimization and performance of agro-processing firms in Kiambu County, Kenya.

**Table 6: Correlation Coefficients**

| | | Performance of agro-processing firms Kiambu County | Inventory optimization. | Sustainability optimization | Demand forecasting | Reduced cost optimization |
|---|---|---|---|---|---|---|
| Performance Of Kiambu County | Pearson correlation | 1 | | | | |
| | Sig. (2-tailed) | | | | | |
| Inventory optimization | Pearson correlation | .571* | 1 | | | |
| | N. | 189* | | | | |
| | Sig. (2-tailed) | .000 | | | | |
| Sustainability optimization. | Pearson correlation | .1894** | .264 | 1 | | |
| | N | 189 | 189 | | | |
| | Sig. (2-tailed) | .002 | .0189 | | | |
| Demand forecasting | Pearson correlation | .765** | .314 | .335 | 1 | |
| | N | 189 | 189 | 189 | | |
| | Sig. (2-tailed) | .001 | .041 | .040 | | |
| Reduced cost optimization. | Pearson correlation | .501* | .240 | .256 | .253 | 1 |
| | N | 189* | 189 | | 189 | |
| | Sig. (2-tailed) | .000 | .035 | .060 | .070 | |
| | | | 189 | 189 | | 189 |

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

From the findings, a positive correlation is seen between each variable and performance. The strongest correlation was established between Demand forecasting and performance of agro-processing firms in Kiambu County in Kenya (r = 0.535 and the weaker relationship found between Reduced cost optimization and performance of agro-processing firms in Kiambu County (r = 0.153). while Sustainability optimization and performance of agro-processing firms in Kiambu County in Kenya were found to be strongly and positively correlating with performance of agro-processing firms in Kiambu County in Kenya correlation coefficient of 0.307 and 0.413 respectively. This is tandem with the findings of Ongeri and Osoro (2021), who observed that all independent variables were found to have a statistically significant association with the dependent variable at over 0.05 level of confidence.

**Regression Analysis**

To establish the degree of the effect of supply chain for a regression analysis was conducted, with the assumption that: variables are normally distributed to avoid distortion of associations and significance tests, which was achieved as outliers were not identified; a linear relationship between the independent variables and dependent variable for accuracy of estimation, which was achieved as the standardized coefficients were used in interpretation. The multiple regression model was as follows:

$Y = \beta_0 + \beta_{1\times1} + \beta_{2\times2} + \beta_3 \times_3 + \beta_4 \times_4 + \varepsilon$ Performance of agro-processing firms in Kiambu County= $\beta_0 + \beta_1$ (Inventory optimization) + $\beta_2$ (Sustainability optimization) + $\beta_3$ (Demand forecasting) + $\beta_4$ (Reduced cost optimization) + error term. Regression analysis produced the efficient of determination and analysis of variance (ANOVA). Analysis of variance was done to show whether there is a significant mean difference between dependent and independent variables. The ANOVA was conducted at 95% confidence level.

**Model of Goodness Fit**

Regression analysis was used to establish the strengths of relationship between the performance of agro-processing firms in Kiambu County in Kenya (dependent variable) and the predicting variables; Inventory optimization, Sustainability optimization ,Demand forecasting and Reduced cost optimization (Independent variables). The results showed a correlation value (R) of 0.765 which depicts that there is a good linear dependence between the independent and dependent variables. This finding is in line with the findings of Ongeri and Osoro (2021). They observed that this also to depict the significance of the regression analysis done at 95% confidence level. This implies that the regression model is significant and can thus be used to evaluate the association between the dependent and independent variables. This finding is in line with the findings of Ittmann (2015), who observed that analysis of variance statistics examines the differences between group means and their associated procedures.

**Table 7: Model of Goodness Fit**

| R | $R^2$ | Adjusted R | Std. Error of the Estimate |
|---|---|---|---|
| 0.765 | 0.795 | 0.731 | 0.064 |

a. Predictors: (constants); Inventory optimization, sustainability optimization, demand forecasting and reduced cost optimization

b. Dependent variable: Performance of agro-processing firms Kiambu County

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With an R-squared of 0.795, the model shows that Inventory optimization, Sustainability optimization ,Demand forecasting and Reduced cost optimization an contribute up to 79.5% on performance of agro-processing firms in Kiambu County in while 20.5% this variation is explained by other indicators which are not inclusive in this study or model. A measure of goodness of fit synopses the discrepancy between observed values and the values anticipated under the model in question. This finding is in line with the findings of Mwakubo and Ikiara (2007).

**Analysis of Variance (ANOVA)**

From the results in Table 8, analysis of variance statistics was conducted to determine the differences in the means of the dependent and independent variables to show whether a relationship exists between the two. The P-value of ≥0.005 implies that performance of agro-processing firms in Kiambu County have a significant relationship with Inventory optimization, Sustainability optimization ,Demand forecasting's and reduced cost optimization which is significant at 95 % confidence level.

**Table 8: ANOVA Test**

| Model | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 4.155 | 1 | 1.059 | .341 | .001 |
| Residual | 6.466 | 188 | .530 | | |
| **Total** | **10.611** | **189** | | | |

**Regression Coefficients of Determination**

To determine the relationship between the independent variables and the dependent variable and the respective strengths, the regression analysis produced coefficients of determination. Findings in Table 9 reveal a positive relationship between the performances of agro-processing firms in Kiambu County in Kenya,

$Y = \beta_0 + \beta_{11} + \beta_{22} + \beta_{3\,3} + \beta_{4\,4} + \varepsilon$; where,

Y= performance of agro-processing firms in Kiambu County in

$\beta_0$ = constant;

$\beta_1$ - $\beta_4$ = Beta coefficients;

$_1$ = Inventory optimization

$_2$ = Sustainability optimization

3 =Demand forecasting

$_4$ = Reduced cost optimization and

$\varepsilon$ = Error term,

From the result shown below, it's clear that when all the independent variables are regressed against the dependent variable the constant gives a negative result meaning there is a strong relationship and how each predator has an effect on the dependent variable.

**Table 9: Regression Coefficient Results**

| | Unstandardized coefficients | | Standardized coefficients | | |
|---|---|---|---|---|---|
| | **B** | **Std. Error** | **Beta** | **T** | **Sig.** |
| (Constant) | -.134 | .060 | -1.144 | 4.004 | .002 |
| Inventory Optimization | .471 | .132 | .555 | 5.472 | .003 |
| Sustainability Optimization | .211 | .067 | .162 | 2.471 | .001 |
| Demand Forecasting | .140 | .059 | .563 | 4.355 | .004 |
| Reduced Cost Optimization | .261 | .115 | .321 | 2.602 | 0.001 |

a. Predictors: (constants), Inventory optimization, sustainability optimization Demand forecasting and Reduced cost optimization

b. Dependent variable: Performance of agro-processing firms in Kiambu County in Kenya

A unit change in Inventory Optimization would thus lead to a .471 effect on performance of agro-processing firms in Kiambu County in Kenya sector ceteris paribus; while a unit change in Sustainability optimization would have an effect of .211 change in performance of agro-processing firms in Kiambu County of Kiambu County; also unit change of Demand Forecasting would lead to .140 of performance of Kiambu County and finally a unit change in Reduced Cost Optimization would lead to .261 on performance of agro-processing firms in Kiambu County in Kenya. This finding is in line with the findings of Ongeri and Osoro (2021). This implies that among other factors, Inventory optimization, Sustainability optimization, Demand forecasting and Reduced cost optimization are significant determinants of performance of agro-processing firms in Kiambu County, Kenya.

## CONCLUSION AND REOMMENDATIONS

### Conclusion

The study concludes that Inventory optimization have broadly impacted on performance of agro-processing firms in Kiambu County, Kenya. The findings conclude that Kenya should drive to embrace the best performance of agro-processing firms in Kiambu County after improving supplier evaluation in Kenya. When public-private partnerships is embraced through Sustainability optimization, Demand forecasting, and Reduced cost optimization then the implementation of performance of agro-processing firms in Kiambu County, Kenya.

### Inventory Optimization

The study concludes that there is a positive relationship between Inventory optimization and Performance of agro-processing firms Speciation identification, periodic design assessment, continues improvement and proactive assessment are among the Inventory optimization factors that significantly influenced the performance of agro-processing firms in Kiambu County, Kenya. The study further concludes that by implementing Inventory optimization has enhanced performance of agro-processing firms in Kiambu County, Kenya, leading to operational increase in efficiency and effectiveness .Therefore, the study concludes that agro-processing firms in Kiambu County, Kenya has significantly increased their suppliers' quality management in the In Kenya government in the supply chain practices.

**Sustainability Optimization**

The study concludes that Sustainability optimization influences performance of agro-processing firms in Kiambu County, Kenya. The suppliers during evaluation was through adherence to the set criterion in the bid documentation during the advertisement focusing on Sustainability optimization. A well-integrated internal supply chain should provide excellence in Sustainability optimization on performance of agro-processing firms in Kiambu County, Kenya. Through embracing Sustainability optimization has benefited from facilitated teamwork, resource allocation and fulfilment of set goals between complementary functions. This has made it easy for the In Kenya to ensure increased Service delivery to the community. Therefore, the study concludes that Kiambu County agro-processing firms in Kenya has experienced significant increase in growth, through Sustainability optimization in the supply chain practices in supply chain.

**Demand Forecasting**

Further, the study concludes that Demand forecasting had a positive effect on performance of agro-processing firms in Kiambu County, Kenya. The study established that competence reviews, supplier performance, Supplier skills, supplier knowledge, supplier training, Kiambu County in Kenya is able to identify problems and find solutions in a timely manner to ensure Demand forecasting of the goods and services delivered. From the findings, the study concludes that increasing Demand forecasting evaluation can leads to increased performance of agro-processing firms in Kiambu County, Kenya by supply chain practices.

**Reduced Cost Optimization**

The study concludes that there is a positive relationship between reduced cost optimization and performance of agro-processing firms in Kiambu County, Kenya. Partnership enforcement policy, collective bargaining, alternative dispute resolution processes, free expression of concerns by involved practices are among the coordination factors that significantly influenced the performance of agro-processing firms in Kiambu County, Kenya. The study further concludes that by adopting alternative coordination and partnership mechanisms as it was observed at Kiambu County in the level of performance of agro-processing firms in Kiambu County has increased. Therefore, the study concludes that Kiambu County in Kenya has been experiencing significant increase in service delivery through embracing proper coordination in the supply chain practices.

**Recommendations**

The study recommends and on firms that the implementation of supply chain optimization practices and performance of agro-processing firms in Kiambu County, Kenya was significant relationship. That in future different counties needs to strengthen performance of agro-processing firms Kiambu County in Kenya and procurement process to all counties in Kenya, with the help of Inventory optimization, Sustainability optimization Demand forecasting and Reduced cost optimization. This study therefore sought to explore what past scholars had said on factors affecting supply chain best practices on performance of agro-processing firms in Kiambu County, Kenya and tested viability of best procurement policy and procedures in the public entities in Kenya. That from the foregoing, this study recommends that the best Performance of agro-processing firms in Kiambu County, Kenya should strive to be proactive on how to perform better to retain integrity and improve transparency and accountability on

performance of agro-processing firms in Kiambu County. The study has now filled the existing gap after the reaction of this new knowledge.

**Inventory Optimization**

The study recommend that Inventory optimization formalizes relations between practices within a robust legal framework, but is much more besides; it is an opportunity to define the arrangements that encompass every aspect of what outcomes the Kiambu County in Kenya wants from the supplier and how it wants the relationship to work. This means that the In Kenya needs to take an active role in the development of the quality mechanism early on; it should not be left as a supplementary activity post negotiation. At preparation of every quality management can contribute to supplier evaluation on performance of agro-processing firms in Kiambu County, Kenya. Proper Inventory optimization can result to high procurement in Kiambu County, Kenya.

**Sustainability Optimization**

This study recommends that Sustainability optimization had a good relationship with performance of agro-processing firms in Kiambu County in Kenya. Hence effective Sustainability optimization can minimizes or eliminates problems and potential claims towards performance of agro-processing firms in Kiambu County, Kenya perspective. A key factor in successful Sustainability optimization is being arable to give credit to customers. It is essential for Sustainability optimization to understand the provisions of the purchase document, have the ability to communicate financial obligations to all practices involved, and maintain control over the performance of agro-processing firms in Kiambu County. A good supplier manager ensures that the Sustainability optimization requirements are satisfied, that the goods and services are delivered in a timely manner, and that the financial interests of the In Kenya are protected. The procurement staff at Kiambu County in Kenya should ensure that they do proper Sustainability optimization by maintaining an updated form of the process; assessing and managing supplier involvement; supplier being paid on time; delivering at the right time; inspection or audit of all documents before settling payment. By allocating all the necessary resources to a reputable suppliers through efficiency and effectiveness analysis of previous records in the supply chain practices.

**Demand Forecasting**

The study recommends that Demand forecasting had a strong relationship with performance of agro-processing firms in Kiambu County in Kenya. There should be a thorough and independent review that is informed by those involved in establishing and managing the Demand forecasting. The evaluation was need to be tailored to the particular circumstances of the In Kenya but should consider both the effectiveness and efficiency of the arrangement. To get the best out of the evaluation, entities should: review all aspects of performance of agro-processing firms in Kiambu County and its management; provide feedback to the contractor; this should not be done as part of another procurement process; report to stakeholders; and identify lessons learned. The management of Kiambu County in Kenya should ensure regular supplier evaluation through well-established monitoring and evaluation of performance of agro-processing firms in Kiambu County. This was ensure that there is input correctives measures to hedge against deviation of actual results against standards in the supply chain practices.

### Reduced Cost Optimization

This study recommends that reduced cost optimization had a strong relationship with performance of agro-processing firms in Kiambu County, Kenya. When relationship are not properly managed, they may cause supplier delays, undermine team spirit, increase delay costs, and, above all, damage business relationships. With the increase in the number of participants in a supplier management, it is obvious that more business interactions and arguments end up with an increase in the number of supplier relationship disputes. Research in preventing and resolving relationship disputes supports the effort for better understanding and harmonization of the different cultures. Therefore, this study recommends to the management of Kiambu County in Kenya to enhance and upgrade on the implementation of all applicable alternative disputes resolution mechanisms so to protect relationship with its stakeholders in the supply chain practices.

### Areas for Further Studies

This study focused on inventory optimization, Sustainability optimization, Demand forecasting and Reduced cost optimization and performance of agro-processing firms in Kiambu County, Kenya. The study therefore recommends a further study to be conducted to other counties in Kenya. Then get their findings and compare with this and agree or disagree. The study also recommends replication of the study in other sectors such as manufacturing sector and public sector to allow comparison of research findings. Future researchers an investigate the factors affecting supply chain best practices broadly in all areas of concern in this profession on performance of agro-processing firms the supply chain practices.

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