Network Structure Innovation and Demand Forecasting Performance of Oil Marketing Companies in Kenya

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Abstract

Purpose: The study focused on the influence of network structure innovation on the demand forecasting performance of oil marketing companies in Kenya. The research used adaptive transport models, collaborative network platforms, scenario planning and testing as indicators for measuring business process innovation.

Methodology: The study was based on a positivist research philosophy and employed a mixed-methods research design. The population consisted of 143 registered oil marketing companies, from which a purposive sample of 81 was selected. Primary data were collected through open-ended questionnaires. Secondary data were obtained from EPRA reports on demand performance and analysed using the moving-average method. 10% of the sample size, or 10 oil marketing companies, was used for a pilot study. A total of 51 valid responses were analysed using descriptive statistics, Pearson's correlation, and regression, while qualitative data were analysed thematically.

Findings: The results indicated that oil marketing companies have moderately to highly adopted network structure innovations. There was a positive and statistically significant correlation between network structure innovation and demand forecasting performance. Regression analysis further confirmed that network structure innovation had a positive and statistically significant effect on demand forecasting performance.

Unique Contribution to Theory, Practice, and Policy: The findings demonstrate how innovative network structures enhance information flows and inter-firm connectivity to improve demand forecasting performance, while extending Network Theory by quantifying the effects of network agility on forecasting outcomes. In practice, managers could integrate network structure innovations into operational and strategic practices to strengthen collaborative partnerships with logistics providers and suppliers. Policy makers can promote agile operations, collaboration, and technology adoption to support the implementation of advanced forecasting technologies.

Keywords: Network Structure Innovation, Adaptive Transport Models, Collaborative Network Platforms, Scenario Planning and Testing, Demand Forecasting Performance

1.0 INTRODUCTION

The concept of network structure innovation in oil marketing companies (OMCs) encompasses both the physical infrastructure for product distribution and organisational design that enhance market responsiveness and agility (Dias et al., 2025). Flexible network structures facilitate the sharing of resources, knowledge, and software across various business units (Silicon Valley Innovation Center, 2024). These operational network structures encompass physical infrastructure and IT integration. Building resilient networks improves reliability and provides redundancy, helping to minimise downtime, boost operational efficiency, and enhance safety and compliance. Effective communication within these networks enables real-time problem-solving and ensures regulatory compliance. Implementing IT enables remote process control, reducing operational costs, increasing uptime, and improving overall performance (Moxa, 2023).

Retail network structures include service stations and convenience stores and focus on capitalising on market opportunities and responding swiftly to market changes (Rubeis et al., 2021). This is largely achieved through data-driven analytics and AI to identify optimal locations for new sites and to optimise the product mix within each convenience store, extending beyond limited fuel and lubricant offerings (Accenture, 2023; Gosling, 2025). Oil marketing companies also design the retail network to incorporate digital media screens and advertising platforms to create new revenue streams and enhance marketing synergies with other business lines (Rubeis et al., 2021; Gosling, 2025). From a supply chain perspective, structural innovation concerns the changes within the supply chain network. It focuses on the vertical structure, which includes the number of suppliers or customers, and the horizontal structure, which emphasises the number of tiers in the supply chain. The network structure includes elements such as outsourcing, third- and fourth-party logistics providers (3PL & 4PL), partnerships and collaborations, and distribution channels (Ivanov et al., 2020).

Global perspective

Network structure innovation influences technological progress through organised connections in inventor and inter-industry networks. Firms in the United States gain generative appropriability from integrated intrafirm inventor networks that expedite follow-on inventions. China's strategic emerging industries, analysed using 8.7 million patents from 2012-2021, demonstrate that relational and structural embeddings in inter-industry networks foster collaborative performance (Argyres et al., 2025). In Chinese industries, network embeddings improve collaborative innovation by enabling broader and deeper knowledge sharing from partners. Intra-industry density positively moderates this effect, as observed in China's high-performing sectors such as AI and new energy. Global manufacturing GVCs, based on PCT patents from 50 economies (2007-2021), expand as GIN embeds breadth and depth, particularly for leaders such as the U.S., Germany, and Japan (Zhang et al., 2025). U.S. firms lead via internal networks, Chinese industries via cross-sector connections, and developed economies dominate GINs, while developing nations

risk lock-in without strong IPR protection. These insights from U.S. corporate data, Chinese patents, and a global analysis of 50 economies provide a comprehensive view of network-driven innovation (Shi & Xiao, 2024).

Africa perspective

Research on technological advancement and innovation in African oil marketing and the broader oil industry highlights the pivotal role of collaborative networks, inter-firm alliances, and structured knowledge transfer mechanisms in fostering innovation, particularly in resource-constrained environments. In Nigeria, alliances between multinational companies and indigenous firms have been shown to be effective channels for transferring technological, managerial, and market knowledge, thereby strengthening the innovation capacity of local partners (Okonkwo, 2025). Studies of inter-firm networks in Ghana, South Africa, and Angola indicate that networked collaboration among oil firms, research institutions, and industry partners enhances the adoption of new technologies and facilitates process and product innovations, even where internal research and development resources are limited (Uko & Hamilton, 2020; Adeyeye et al., 2025). These networks enable firms to access both explicit knowledge, such as technical manuals and operational procedures, and tacit knowledge, such as managerial expertise and market insights, both of which are critical for sustaining competitive advantage. Overall, evidence from across Africa demonstrates that structured inter-organisational linkages serve as conduits for innovation, enabling oil marketing companies to leverage external knowledge, improve technological competencies, and enhance operational and market performance in challenging economic contexts.

The innovation in network structures across Africa is primarily driven by the transition from isolated entities to integrated, collaborative ecosystems. This structure is designed to foster open collaboration and the development of African-made solutions by connecting entrepreneurs, tech hubs, and institutional funders. This network innovation relies heavily on information and communication technology (ICT) to bypass traditional governance weaknesses (Asongu et al., 2025; Afrilabs, 2019).

Kenya Perspective

In Kenya, network restructuring, particularly through improved digital and organisational linkages, enhances collaboration and efficiency across institutions. Network transformation in public sector institutions has modernized network structures which has improved communication, reduced information silos, and supported faster decision-making across ministries and agencies. Shifting from fragmented and hierarchical structures to more integrated network arrangements enable organizations to respond more effectively to complex and dynamic operational demands (Too & Mutuku, 2025).

Network structures and collaboration mechanisms are vital in shaping technological progress and performance in oil marketing companies. In Kenya's downstream petroleum sector, strategic

collaborations and cooperative networks among oil marketing firms have been shown to significantly impact firm performance. Mtange and Deya (2025) found that strategic alliances, cooperative storage arrangements, and shared service networks positively relate to improved operational efficiency and competitiveness among oil marketing firms, demonstrating that inter-organisational linkages influence firm outcomes by enabling the sharing of resources and coordinated actions.

The health sector in Kenya also illustrates that network structure innovation improves system-level performance through coordinated network design. Adopting a hub-and-spoke network structure has strengthened linkages among health facilities, improved referral systems, and enhanced coordination of resources, including supply chains and information systems. Integrating multiple actors within a defined network reduced fragmentation and improved service delivery across counties in Kenya (Amboko et al., 2025). These findings suggest that innovative network structures, when effectively coordinated, enhance visibility, responsiveness, and overall performance, particularly in environments characterised by uncertainty and resource constraints.

Demand forecasting

Demand forecasting is a strategic process that helps deter speculation, enhancing efficiency and reducing costs. Decision-making in the supply chain is supported by demand forecasts from sales and marketing, customer feedback, and inventory turnover within the organisation. The decisions are derived from different forecast requirements, such as individual SKU-level forecasts, lead-time-based inventory management, and historical data over longer horizons, which are required for supply chain strategic decisions. Forecasting accuracy is usually enhanced by combining data at lower levels, disaggregating data at higher levels, or merging forecasts across multiple levels of aggregation (Babai et al., 2022).

Demand prediction involves using forecasting methods to determine future customer demand. Demand forecasts influence organisations' most critical decisions, such as marketing budgets, procurement contracts, production schedules and sales quotas. Demand prediction uses a range of qualitative and quantitative approaches to assess customer satisfaction, including trend analysis, simulation, the Delphi method, and market research. Demand prediction, when adopted in inventory management, helps reduce inventory costs, support capacity planning, and effectively fulfil customer needs while integrating backwards and forward supply chains. (Zougagh et al., 2020).

Oil marketing companies in Kenya

The oil marketing companies play an important role in ensuring that the economy is running, especially for Kenya, which consumes about 4.8% of its GDP in imports. Network structure innovation enables organisations to be reliable and agile in distributing oil and petroleum products, thereby meeting customer demand, especially in an industry riddled with disruptions and external

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challenges. Oil marketing companies in Kenya invest heavily in their network structures to optimise their retail networks and convert service stations into centres that can streamline their supply chains through innovations to increase efficiency and competitive advantage (Rubeis et al., 2021). The adoption, however, is concentrated at the retail level, leaving the supply chain and organisational agility unaddressed and making OMCs vulnerable to operational and infrastructural challenges (Yabarow & Muathe, 2020).

The downstream oil marketing sector in Kenya has faced challenges such as tendering issues, oil price fluctuations, logistics delays, and integration gaps, leading to inefficiencies including reduced competitive advantage, limited supply chain integration, and decreased flexibility (Maondo, 2025). The inability to fully leverage these structural innovations has constrained their competitive advantage and profitability in a rapidly changing industry (Yabarow & Muathe, 2020). This study sought to determine the influence of network structure innovation on demand forecasting performance among oil marketing companies in Kenya, against the backdrop of increasing market volatility, supply chain disruptions, and growing petroleum demand. The study was motivated by persistent challenges of inaccurate demand forecasting, which often result in stockouts, overstocking, logistics inefficiencies, and reduced competitiveness in the sector.

Statement of the problem

In Kenya, oil marketing companies are affected by inaccurate demand forecasting, driven by fragmented data and uncoordinated supply chain processes, which continue to undermine operational efficiency, inventory management, and competitiveness, thereby challenging the rapidly growing oil marketing sector. The oil marketing sector in Kenya operates in a complex and volatile environment, where accurate demand forecasting is critical for maintaining supply chain efficiency and profitability (Harun et al., 2025). The rapid increase in industry players since 2015 has led to declining market shares for new entrants and persistent supply chain disruptions. The sector has also experienced a significant surge in petroleum imports, rising by 20.9% from 4.3 million tons in 2023 to 5.2 million tons in 2024 (KNBS, 2025), highlighting a rapidly growing and unpredictable demand landscape that current forecasting approaches fail to manage effectively (EPRA, 2025). Despite projections indicating growth in oil consumption from 4.5 million to 12 million metric tons by 2030, inaccurate demand forecasting continues to hamper operational efficiency, causing costly stockouts, overstocking, and reduced competitiveness due to fragmented data and uncoordinated supply chain processes (Majimbo & Namusonge, 2021; Osoro, 2016). While innovative network structures, such as adaptive transport models, collaborative network platforms, and scenario planning, offer the potential to improve demand forecasting accuracy and overall firm performance (Mtange & Deya, 2025), the sector still lacks effective implementation of these network-based approaches. Consequently, Kenyan oil marketing companies face challenges in achieving integrated supply chain management and optimal inventory distribution, undermining their operational efficiency and market competitiveness. This study examines how

innovations in network structure can mitigate forecasting inefficiencies and improve the performance of oil marketing companies in Kenya.

Research Objective

To assess the influence of network structure innovation for demand forecasting performance of oil marketing companies in Kenya

Research Hypothesis

H_{01} Network structure innovation does not have a statistically significant influence on demand forecasting performance of oil marketing companies in Kenya

2.0 LITERATURE REVIEW

This study focused on network theory, where organisations understand and establish relationships among different members of the supply chain. The theory highlights that effectiveness within a network increases with greater diversity, size, and range. These relationships enhance organisations' resource capabilities and individual competencies (Lavassani & Movahedi, 2010). Complex networks create a structural framework that organisations can use to determine how networks can grow and be sustained through the integration of innovations.

Network theory considers the supply network by positioning firms involved in production or assembly to improve information sharing and resource flows. It explains how firms meet customer demands through either in-house production or sourcing from external suppliers (Wellenbrock et al., 2013). This theory helps organisations restructure their networks to enhance the flow of information, resources, and services, fostering more dynamic, adaptable systems that support long-term innovation and growth. It is particularly useful for network structural innovation because it emphasises understanding relationships and interactions among network partners. By analysing these connections, businesses can pinpoint key influencers, identify bottlenecks, and uncover underused resources, leading to innovative strategies for optimising their network structure. As a result, organisations can achieve more efficient communication, better collaboration, and leverage critical partnerships or hubs within the network (Newman, 2018).

Dixit et al. (2020) analysed the dynamics of supply chain resilience and network structural parameters and how dependent they are on resilience. The study adopted an empirical review of the data, in which supply chain resilience was determined by network density, centrality, and network size. The study further used a conditional value-at-risk (CVaR) approach to conclude that firms with low supply network density and centrality, coupled with high connectivity and network size, exhibit the highest resilience in the market.

Hahn (2020) conducted a study on Industry 4.0 from an innovative supply chain perspective. The research used the term 'business architecture' as a prerequisite for defining the network structure within the supply chain innovation framework. The study identified three key aspects of

architecture: one focusing on the product, which involves selling to customers; a platform for collaboration aimed at adding value across the organization; and a service component where product availability is maintained by the supplier through ongoing value provision. The findings showed that 90% of Industry 4.0 solutions for established companies focused on product-centric approaches, while among start-ups, 56% centered on services and 33% on platforms. However, the study does not clarify how these levels were measured or operationalised. Additionally, it lacks detailed information on sampling, data collection methods, and company characteristics. It remains unclear if statistical tests were performed to assess the significance of the differences between the two groups.

Li, Shi, and Jin (2022) conducted an empirical study involving 362 HEM enterprises to examine how structural innovation affects organisational performance from a dynamic capability perspective. They focused on absorption and transformation capabilities as key aspects of dynamic capability. Using a structural equation model, they analysed the relationships among variables and found that these indicators significantly mediated the link between structural innovation and performance. Their results indicated that structural innovation positively and significantly influences organisational performance. However, since the findings are based on a specific sample of HEM enterprises, their applicability to other industries or regions might be limited.

Network structures and collaboration mechanisms are vital in determining technological progress and performance in oil marketing firms. In Kenya's downstream petroleum industry, partnerships and cooperative networks among oil marketing companies significantly impact their performance. Mtange and Deya (2025) discovered that strategic alliances, shared storage solutions, and joint service networks are positively associated with higher operational efficiency and competitiveness, showing that inter-firm connections influence outcomes by enabling resource sharing and coordinated efforts.

Network-based organisational practices, like supply chain management and technology adoption, play a crucial role in driving innovation within the sector. A study by Kiprop et al. (2025) in the Kenyan oil marketing industry found that adopting digital systems and automated tools was strongly linked to better firm performance, accounting for over 90% of the variation in outcomes. These results show that when strategically implemented, networked technological systems can boost operational efficiency and promote innovation by integrating multiple operational functions, such as inventory, distribution, and customer service, both within and across firms.

Complementary research emphasises the impact of collaborative supply chain practices in oil marketing contexts. Kitaka and Muli (2025) demonstrated that effective supply chain collaboration, including joint planning and shared forecasting with partners, improves the overall performance of oil supply companies in Nairobi, indicating that network coordination among supply chain stakeholders is crucial for sustained performance and potential innovation. Furthermore, Ngugi and Kihara (2025) research showed that the adoption of information

technology and early vendor involvement, both of which require organised interactions with external partners, positively influence performance in oil industry firms, reinforcing the notion that structured network practices foster technological progress.

Conceptual Framework

The model will summarise network structure innovation as the independent variable and demand forecasting performance as the dependent variable.
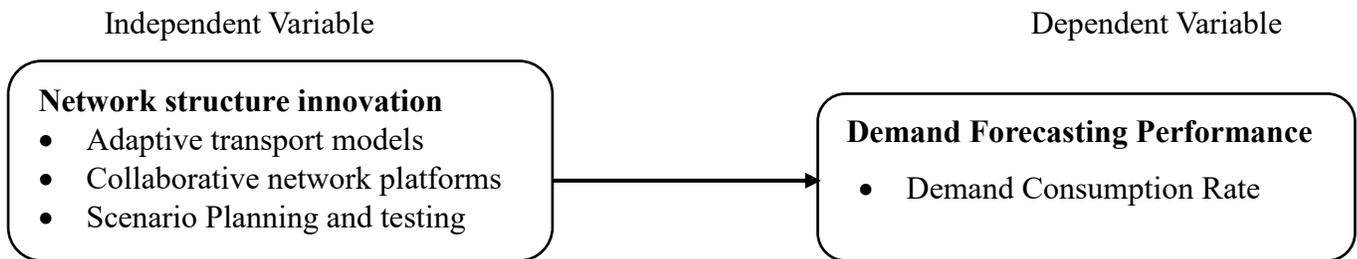
Independent Variable   Dependent Variable

Network structure innovation
- Adaptive transport models
- Collaborative network platforms
- Scenario Planning and testing

Demand Forecasting Performance
- Demand Consumption Rate

Figure1: Conceptual Framework

3.0 METHODOLOGY

The study adopted a positivist research philosophy and a mixed-methods research design to examine the relationship between independent and dependent variables, integrating quantitative and qualitative data collection and analysis. The target population consisted of 143 registered oil marketing companies in Kenya, with a focus on supply chain officers and managers who oversee demand forecasting and operational processes. A purposive sampling technique was employed to select companies with complete demand consumption data from 2021 to 2024, resulting in a sample of 81 companies. Primary data were collected using structured, open-ended questionnaires that incorporated a four-point Likert scale to measure the extent of innovation adoption, ranging from very low to very high. Secondary data were obtained from the EPRA database to supplement primary findings. Qualitative data were analysed using thematic analysis, which involved grouping related themes, reviewing patterns, and providing explanations based on the information collected. Quantitative data were analysed using descriptive statistics (percentages, means, standard deviations) and inferential statistics, including multiple regression and correlation analysis, to evaluate the strength and nature of relationships among variables. Multiple regression was used to show the relationship between the network structure innovation components and demand forecasting performance. The model used was;

$Dfp = \beta o + \beta_1 NSi + e$

> *Where, Dfp* = Demand forecasting performance
>
> βo =constant
>
> *NSi* = Network Structure Innovation   *e*= Error term

4. FINDINGS AND DISCUSSIONS

Descriptive Analysis

The respondents were asked to indicate the extent to which the specific network-structure innovation has been adopted to enhance flexibility in their supply chains. The responses were categorised into a scale: Low (0-24%) - L, Partial (25-49%) - P, Moderate (50-74%) - M, High (75-100%) - H. A percentage mean was calculated to accurately reflect the degree of innovation adoption. The survey findings reveal moderate to high agreement among respondents on supply chain agility practices in Kenyan oil marketing companies, with mean percentages ranging from 57.35% to 70.5% and standard deviations around 0.62-0.78, indicating consistent perceptions of capabilities like dynamic route changes (mean=69, SD=.681), logistics collaborations (mean=70.5, SD=.623), and real-time information exchange during emergencies (mean=67.8, SD=.701). These results suggest embedded resilience strategies, aligning with studies showing that supply chain agility, through decisiveness, swift action, and alertness, significantly enhances competitiveness in Kenya's liquefied petroleum gas sector (Sabdio & Samson, 2018). Similarly, risk reduction strategies, including collaboration and flexibility, positively influence supply chain resilience in the Kenyan petroleum industry, supporting the observed high endorsement of partner sharing and scenario planning (Lambaino, 2019).

However, the slightly lower mean for simulation-based adjustments (57.3, SD=.782) hints at implementation gaps, potentially contradicting findings that innovative practices such as just-in-time and integration are widely adopted and drive performance in oil marketing firms, though they are challenged by training deficits and technology underinvestment (Shalakha, 2015). This partial divergence underscores context-specific barriers in Kenya, such as infrastructure limitations, which prior research identifies as hindering logistics efficiency despite positive correlations with storage and transport capabilities (Okitte et al, 2024). Overall, the findings affirm agility's role but call for targeted investments to bridge variances with broader empirical evidence (Barua, 2010).

Table 1: Descriptive Analysis for Network Structure Innovation

	L	P	M	H	PM	SD
Transport routes can be dynamically changed in response to disruptions	0 0.0%	19 37.3%	25 49.0%	7 13.7%	69%	.681
Our company use scenario planning to prepare for supply chain uncertainties	3 5.9%	21 41.2%	21 41.2%	6 11.8%	64.8%	.779
Our company collaborates with logistics partners on capacity sharing or joint deliveries	0 0.0%	15 29.4%	30 58.8%	6 11.8%	70.5%	.623
Our company network is agile in onboarding new suppliers during peak demand	2 3.9%	13 25.5%	31 60.8%	5 9.8%	69%	.681
The distribution system is supported by decentralised or backup nodes	1 2.0%	21 41.2%	24 47.1%	5 9.8%	66.3%	.688
Our firm adjusts sourcing or fulfilment plans based on simulation outputs	8 15.7%	22 43.1%	19 37.3%	2 3.9%	57.3%	.782
Information exchanged with stakeholders is in real time during emergencies	1 2.0%	19 37.3%	25 49.0%	6 11.8%	67.8%	.701
The network structure is flexible in maintaining service levels under regional fuel shortages	1 2.0%	19 37.3%	26 51.0%	5 9.8%	67.3%	.678

Demand Forecasting Performance

The graph in Figure 2 shows the annual actual and projected demand for petroleum products in Kenya from 2021 to 2024. The graph shows a clear change in forecasting accuracy and market behaviour between the first and second halves of the period. In 2021 and 2022, the oil marketing companies tended to over-forecast. Predicted demand exceeded actual results, especially in 2022, with a gap of over 600,000 units. This suggests that the initial projections might have been overly optimistic or failed to account for external market slowdowns. Such differences can lead to high inventory costs and possible overinvestment in production capacity, underscoring the need for more cautious estimation models during those periods. On the other hand, the trend reversed in 2023 and 2024, moving toward under-forecasting. In these years, actual demand was about

316,000 and 445,000 units higher than predictions. While surpassing sales goals is usually a good thing, ongoing under-forecasting can lead to problems like stockouts, high shipping costs, and strained relationships with suppliers. The shift from a surplus to a deficit figures points to a volatile market where the current forecasting approach may not be keeping up with real consumption recovery or growth. External shocks such as global fuel price instability, supply chain disruptions, or domestic policy constraints, may have suppressed actual consumption below predicted levels.

The graph illustrated inconsistencies between projected and actual consumption, suggesting that the forecasting models in use may require methodological improvements, particularly in capturing emergent economic, technological, and policy-related variables.
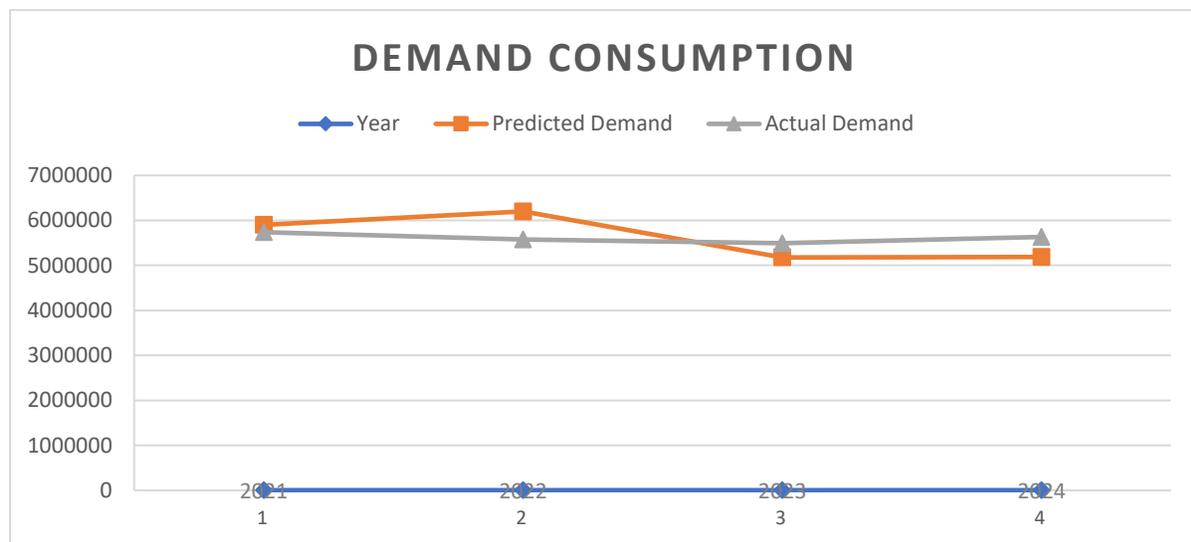

Figure 2: Trend of Oil Demand Performance

Qualitative Analysis

Strategic collaborations with other partners in the supply chain and with other oil marketing companies are common. Oil marketing companies have chosen to form alliances or mergers with other firms to expand their network. This enhances their logistics and storage capacity, helping them maintain a competitive edge. Oil marketing companies can consolidate their synergies and reduce the costs of establishing filling stations and storage facilities. Muchiri et al. (2017) confirmed that oil marketing companies engaged in strategic alliances to expand their product lines, boost creativity, reach more customers, and access market niches.

Oil marketing companies have also adopted joint research and development with partners as a strategy to stay competitive. These organizations focus their innovation efforts on refining processes for final consumption, impacting their business and customers. Partnered R&D involves sharing knowledge and information on market trends and new innovations. Wang (2024) explains that tight, concentrated networks in joint R&D foster the generation and sharing of innovative ideas and information within these networks.

Correlation Analysis

The study wanted to investigate whether a significant relationship exists between NSI and demand forecasting performance (DFP). Table 2 presents the results of the Pearson correlation analysis between network structure innovation and demand forecasting performance among oil marketing companies. The analysis shows a strong positive correlation ($r = 0.768$, $p < 0.01$), indicating that higher levels of network structure innovation are associated with better demand forecasting performance. The significance value ($p = 0.000$) confirms that this relationship is statistically significant at the 1% level (two-tailed), suggesting that the observed association is unlikely to be due to chance. With a sample of 51 companies, these findings imply that companies that implement agile network structures, such as adaptive transport routes, collaborative logistics, and flexible supplier onboarding, are more likely to achieve accurate and reliable demand forecasting.

Table 2: Correlation Analysis for Network Structure Innovation and Demand Forecasting Performance

			Demand Forecasting Performance	Network Structure Innovation
Demand Forecasting Performance		Pearson Correlation	1	.768**
		Sig. (2-tailed)		.000
		N	51	51
Network Structure Innovation		Pearson Correlation	.768**	1
		Sig. (2-tailed)	.000	
		N	51	51

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

Regression Analysis

The model summary in Table 3 shows there was a moderate correlation between network structure innovation (NSI) (.768) and demand forecasting performance. Table 3 presents the regression model summary for the relationship between network structure innovation (predictor) and demand forecasting performance (dependent variable). The coefficient of determination (R^2) is 0.591, suggesting that approximately 59.1% of the variation in demand forecasting performance can be explained by network structure innovations implemented by the oil marketing companies. The adjusted R^2 of 0.582 accounts for the sample size and indicates that the model maintains a strong

explanatory power even after adjusting for potential bias. The standard error of the estimate (0.37154) reflects the average distance between observed values and the regression line, indicating a fairly good fit for the model. These results suggest that network structure innovations significantly improve demand forecasting performance, emphasising the importance of adaptive network practices, collaborative logistics, and flexible supply chain mechanisms in enhancing operational efficiency in the oil marketing sector.

Table 3: Model Summary for Network Structure Innovation and Demand Forecasting Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.768a	.591	.582	.37154

a. Predictors: (Constant), Network Structure Innovation

ANOVA results for the regression model examining the effect of network structure innovation on demand forecasting performance are presented in Table 4. The model yielded an F-statistic of 70.661 with a p-value of 0.000, indicating that the regression model is statistically significant at the 1% level. This suggests that the model provides a better fit to the data than a model without predictors. The regression sum of squares (9.754) represents the variation in demand forecasting performance explained by network structure innovation, while the residual sum of squares (6.764) captures the unexplained variation. With 49 degrees of freedom for the residuals, the mean-square values further confirm the model's strength. These results validate the predictive power of network structure innovation, confirming that improvements in network agility, collaborative logistics, flexible supplier onboarding, and adaptive distribution systems significantly enhance the accuracy and reliability of demand forecasting in oil marketing companies. Similarly, Li et al., (2022) validated that structural innovation had a positive and significant impact on the performance of HEM enterprises.

Table 4: ANOVA for Network Structure Innovation and Demand Forecasting Performance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9.754	1	9.754	70.661	.000[b]
	Residual	6.764	49	.138		
	Total	16.518	50			

a. Dependent Variable: Demand forecasting performance

b. Predictors: (Constant), Network Structure Innovation

Regression coefficients for the model examining the effect of network structure innovation on demand forecasting performance are presented in Table 5. The model for these results was: *Demand Forecasting Performance=1.328 + 1.055Nsi.* The unstandardized coefficient (B) for network structure innovation is 1.055, indicating that for every one-unit increase in network structure innovation, demand forecasting performance increases by 1.055 units, holding all other factors constant. The intercept is 1.328, representing the predicted demand forecasting performance when network structure innovation is zero. The standardised coefficient (Beta = 0.768) confirms a strong positive relationship between network structure innovation and demand forecasting performance. The associated t-value of 8.406 and p-value of 0.000 indicate that this effect is statistically significant at the 1% level, providing strong evidence that network structure innovations are a key predictor of demand forecasting performance in oil marketing companies.

In practice, the results indicate that improving agile network structures, adaptable transport systems, collaborative logistics, and flexible supplier onboarding can greatly enhance the accuracy and reliability of demand forecasting, thereby supporting more efficient supply chain operations.

Table 5: Coefficients for Network Structure Innovation and Demand Forecasting Performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.328	.327		4.061	.000
	Network Structure Innovation	1.055	.126	.768	8.406	.000
a. Dependent Variable: Demand forecasting performance						

Hypothesis Test

Table 5 showed that NSI was statistically significant (p=.000), indicating that the result was strong enough to reject the null hypothesis and leading to the conclusion that NSI significantly influenced demand forecasting performance. This is supported by Li et al. (2021), where structural innovation had a positive and significant impact on organisational performance.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The findings revealed that oil marketing companies have moderately to highly adopted network structure innovations such as dynamic transport routing, collaborative logistics, flexible supplier onboarding, decentralised distribution systems, scenario planning, and real-time information sharing. Descriptive data indicate that companies have adopted agile network practices to varying degrees, including dynamic transportation routes, collaborative logistics, adaptable supplier onboarding, decentralised distribution points, and real-time information sharing. Correlation analysis reveals a strong positive link (r = 0.768, p < 0.01) between network structure innovation and demand forecasting success. Regression findings confirm that network structure innovation accounts for around 59.1% of the variation in demand forecasting performance (R^2 = 0.591), with a statistically significant effect (p < 0.01). Specifically, a one-unit increase in network structure innovation results in a 1.055-unit improvement in demand forecasting. These results imply that firms should foster robust, collaborative relationships with network partners, promoting trust and information sharing. This collaborative, flexible network approach enhances a company's ability for accurate, responsive demand forecasting, supporting improved strategic planning and operational efficiency.

Conclusion

The findings indicated that network structure innovation (NSI) was moderately adopted, with a focus on moderate collaboration with logistics partners, dynamic transport route adjustments, collaborative practices, and adaptive network designs. Companies showed a strong inclination to collaborate with logistics partners, especially through capacity sharing and joint deliveries.

However, there was less adoption in adjusting sourcing or fulfilment plans based on simulation outputs, highlighting a gap in leveraging advanced analytical and modelling tools for strategic network optimisation and scenario planning. The inferential analysis confirmed that NSI significantly and positively affected demand forecasting performance. This demonstrates that NSI is an effective predictor, underscoring the importance of an organised and flexible network for accurate demand forecasting. A well-structured, innovatively managed network enables rapid information exchange, enables quick responses to supply chain disruptions, and provides a broader view of market dynamics. These qualities are crucial for accurate demand forecasting, enabling strategic planning and improving operational performance throughout the supply chain. The ability to reconfigure networks in real-time supports a more informed, agile forecasting process, reducing lead times and boosting market responsiveness. The results suggest a collaborative approach, coupled with flexible network designs, directly enhances a firm's ability to conduct accurate and responsive demand forecasting, leading to better strategic planning and operational execution.

Recommendations

Policy Recommendations

Policymakers in Kenya's oil marketing sector should prioritize promoting flexible operations, fostering collaboration, and encouraging the use of new technologies. The Energy and Petroleum Regulatory Authority (EPRA), along with the Ministry of Energy, needs to develop regulatory frameworks and offer incentives to encourage companies to adopt adaptive transportation strategies and decentralised distribution methods, especially since many firms already have the capacity to dynamically modify their transport routes. Furthermore, EPRA, Kenya Petroleum Refineries Limited (KPRL), and the Petroleum Institute of East Africa (PIEA) should work together to establish sector-wide collaboration platforms.

Policymakers should also support the adoption of advanced forecasting technologies, including simulation-based planning and predictive analytics, as current adoption levels are moderate to low. Regulators such as EPRA and the Kenya Pipeline Company (KPC) should establish standards for real-time information sharing to ensure seamless communication during supply chain emergencies.

Management Recommendations

The study highlights the importance of embedding network structure innovations into operational and strategic practices to enhance demand forecasting performance. Top management, supply chain managers, and operations heads should implement agile network structures, including flexible supplier onboarding and adaptive transport routes, as these practices are strongly correlated with improved forecasting performance.

Firms should also strengthen collaborative partnerships with logistics providers and suppliers, formalising joint delivery and capacity-sharing arrangements, building on the high adoption observed. Strategic planning must integrate network innovation objectives, and management

should invest in staff training and capacity building to reduce disparities in the adoption of network innovations, equipping supply chain officers and managers with the skills to leverage agile, collaborative, and technology-enabled practices for more reliable forecasting and operational efficiency.

Further Research Recommendations

Future research should consider employing longitudinal studies to track network structure over longer periods, helping assess sustainability amid changing market volatility in Kenya's oil sector. Comparing different East African countries could reveal regional variations and best practices for oil marketing companies. It is also crucial to investigate causal mechanisms through experimental designs or structural equation modelling to understand mediation effects. Moreover, studying how integration with other innovation types, such as process or product innovations, affects forecasting performance would offer a more complete perspective.
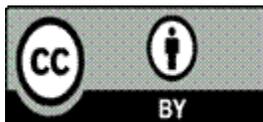
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