Perceived Economic Order Quantity Related Inventory Management Practices and Operational Performance: The Moderating Role of Supply Chain Uncertainty At Training Heights Limited, Abuja

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ABSTRACT

Uncertainty in inventory replenishment and procurement operations has raised concerns about the relationship between inventory management practices and operational performance. This study examined the relationship between perceived Economic Order Quantity (EOQ)-related inventory management practices and operational performance, considering the moderating role of supply chain uncertainty in Training Heights Limited, Abuja. A cross-sectional survey research design was adopted, involving a population of 205 employees selected through a census approach. Primary data were collected using a structured five-point Likert-scale questionnaire, with 188 valid responses analysed through hierarchical moderated regression using IBM SPSS Statistics version 27. The findings revealed positive associations between perceived order quantity optimisation and cost efficiency, and between inventory cost management and inventory availability. Supply chain uncertainty significantly and negatively moderated both relationships, accounting for additional explained variances of 5.9% and 6.6%, respectively. The study concluded that employees' favourable assessments of EOQ-related inventory management practices were associated with favourable assessments of operational performance, although these relationships weakened under higher perceived supply chain uncertainty. It recommended flexible inventory planning, periodic assessment of procurement conditions and improved supplier coordination. Since the study relied exclusively on questionnaire responses, its findings reflect perceived inventory management practices rather than objectively verified EOQ implementation or measured inventory cost savings.

Keywords: Economic Order Quantity, inventory management practices, order quantity optimisation, perceived operational performance, supply chain uncertainty.

INTRODUCTION

Operational performance has become a central concern for organisations operating in increasingly volatile and resource-constrained environments. Globally, firms are under pressure to deliver products and services at lower cost, maintain reliable inventory availability, shorten replenishment cycles, and respond quickly to disruptions. These expectations have intensified as supply chains have become more interconnected and, at the same time, more exposed to uncertainty in demand, supplier reliability, transportation and input availability. Operational performance therefore extends beyond routine efficiency. It reflects how well an organisation converts its resources, inventory decisions and supply relationships into dependable day-to-day outcomes. Chen et al., 2023; and Chang et al., 2023 suggest that disruptions in demand and supply conditions can alter ordering decisions, inventory levels and cost structures, making operational performance partly dependent on how intelligently firms manage inventory under uncertainty.

The Economic Order Quantity (EOQ) model in this context remains one of the most established approaches for structuring inventory decisions. Broadly, EOQ seeks to determine an economically appropriate quantity to order by balancing ordering costs against inventory holding costs. Although the traditional model assumes relatively stable conditions, contemporary applications increasingly accommodate uncertainty, disruption and imperfect operating environments (Sremac et al., 2018; Khalilpourazari et al., 2019; Tziora et al., 2026). For Training Heights Limited, Abuja, EOQ application can be viewed through order quantity optimisation and inventory cost management. Order quantity optimisation concerns determining replenishment volumes that avoid excessive stock while limiting frequent ordering, whereas inventory cost management focuses on controlling the costs associated with procurement, storage, shortages and tied-up capital. Both dimensions are potentially critical because inappropriate order sizes can increase operating expenses, create stock imbalances and weaken service reliability.

Operational performance in Training Heights Limited is particularly concerned with whether inventory and procurement decisions support efficient and uninterrupted operations. In this study, it is reflected through cost efficiency and inventory availability. Cost efficiency represents the organisation's ability to obtain and manage required inventory without avoidable expenditure, while inventory availability concerns having the right materials or items available when needed. These outcomes are closely connected: excessive inventory may increase holding costs, yet insufficient stock may interrupt operations. Research on inventory planning under uncertainty similarly highlights the tension between controlling costs and maintaining adequate availability (Yassine, 2022; Ovezmyradov, 2022).

Supply chain uncertainty complicates this relationship. Demand may fluctuate unexpectedly, suppliers may deliver late, and lead times may change without warning. Under such conditions, ordering quantities that appear optimal in a stable setting may produce different operational outcomes. Yan (2023) specifically links order quantity decisions with uncertainty arising from demand and supply, while Hofstra et al. (2022) show that supply uncertainty can influence ordering behaviour.

Accordingly, the relationship between EOQ application and operational performance in Training Heights Limited may not be entirely direct. Order quantity optimisation and inventory cost management may improve cost efficiency and inventory availability, but the strength of these effects could vary as supply chain uncertainty increases. This possibility makes the moderating role of supply chain uncertainty analytically relevant, especially where conventional EOQ assumptions confront unpredictable real-world supply conditions.

Statement of the Problem

Professional capacity development institutions maintained optimal operational performance by synchronising cost efficiency with uninterrupted inventory availability. Theoretical inventory frameworks, particularly the Economic Order Quantity (EOQ) model, presupposed that determining precise order quantities and systematically controlling holding expenditure balanced procurement expenses against storage charges, thereby preventing material stockouts and sustaining lean operating budgets.

In practice, however, achieving this balance had remained difficult within an operating environment characterised by uncertain demand, supplier unreliability, variable lead times and disruptions in the flow of inventory. For Training Heights Limited, these conditions could have weakened operational performance by increasing procurement and holding costs, creating irregular replenishment patterns and exposing the organisation to stockouts or excess inventory. The practical concern was therefore not merely whether the firm applied EOQ principles, but whether such application continued to produce desirable operational outcomes when supply conditions became unstable.

Empirically, existing studies had not fully resolved this problem. Much of the EOQ literature such as Sremac et al., 2018; Khalilpourazari et al., 2019; Palanivel et al., 2025 concentrated on mathematical optimisation, fuzzy modelling, lot sizing and inventory decisions under uncertainty rather than on organisation-level operational performance outcomes. Other studies such as Yan, 2023; Yassine, 2022; Tziora et al., 2026

examined supply and demand uncertainty in inventory systems, but did not specifically test whether supply chain uncertainty altered the effects of order quantity optimisation and inventory cost management on cost efficiency and inventory availability. These gaps created the need to examine the relationships within Training Heights Limited.

Research Questions

In line with the identified problems, the following questions were raised;

i. What effect does perceived order quantity optimization have on cost efficiency under conditions of supply chain uncertainty in Training Heights Limited?

ii. What effect does perceived inventory cost management have on inventory availability under conditions of supply chain uncertainty in Training Heights Limited?

Objectives of the Study

The main objective of the study is to examine the the relationship between employees' perceptions of EOQ-related inventory management practices and perceived operational performance, considering the moderating role of supply chain uncertainty in Training Heights Limited, Abuja. Specifically, the study seeks to determine the:

i. effect of perceived order quantity optimization on cost efficiency, with supply chain uncertainty as a moderating variable in Training Heights Limited.

ii. effect of perceived inventory cost management on inventory availability, with supply chain uncertainty as a moderating variable in Training Heights Limited.

Research Hypotheses

In order to answer the research question and objectives, the following null hypotheses were suggested:

H_{01}: Supply chain uncertainty does not significantly moderate the effect of perceived order quantity optimization on cost efficiency in Training Heights Limited.

H_{02}: Supply chain uncertainty does not significantly moderate the effect of perceived inventory cost management on inventory availability in Training Heights Limited.

Scope of the Study

This study was delimited to examining the effect of Economic Order Quantity (EOQ) model application specifically dimensioned into order quantity optimization and inventory cost management on operational performance, measured via cost efficiency and inventory availability, alongside the moderating role of supply chain uncertainty. Geographically, the investigation was situated within Abuja, Federal Capital Territory, focusing specifically on Training Heights Limited. Abuja provided a justified empirical setting because it represents Nigeria's administrative and public-sector nerve centre, where corporate training providers contend with erratic government procurement cycles, high commercial leasing and storage overheads, and volatile vendor lead times for specialised imported instructional courseware and technical certifications. Conceptually, the study focused on Economic Order Quantity Model Application, measured through order quantity optimisation and inventory cost management, while operational performance was assessed using cost efficiency and inventory availability. The study further examined supply chain uncertainty as a moderating variable in the relationship between Economic Order Quantity Model Application and operational performance within Training Heights Limited.

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LITERATURE REVIEW

Conceptual Review

Concept of Economic Order Quantity Model Application

Economic Order Quantity (EOQ) Model Application refers to the deliberate use of inventory decision principles to determine replenishment quantities that balance the competing costs of ordering and holding inventory. At its core, EOQ addresses a practical question faced repeatedly by organisations: how much should be ordered at a time so that inventory requirements are met without creating avoidable cost? This concern remains relevant even though contemporary supply chains have become considerably more complex than the stable operating environment assumed by the conventional EOQ model. Modern applications therefore go beyond mechanically applying a fixed formula. They incorporate actual demand patterns, replenishment costs, holding costs, operational constraints and, increasingly, uncertainty surrounding supply and demand. Simulation evidence has demonstrated that EOQ-based inventory policies can outperform existing informal ordering practices in terms of both inventory levels and total inventory costs, while more recent optimisation approaches have extended EOQ reasoning to multi-item and uncertain environments (Azimian & Aouni, 2025; De Cicco et al., 2023).

For Training Heights Limited, EOQ application is better understood as an inventory decision discipline than simply as the use of a mathematical expression. The organisation must decide whether the quantity purchased on each occasion reflects actual operational requirements and whether the resulting inventory position justifies the associated ordering and carrying costs. An overly large order may appear attractive because it reduces ordering frequency, yet it can tie down working capital and increase storage exposure; an undersized order may preserve cash temporarily but create repeated procurement expenses and possible shortages. Evidence from inventory-control applications similarly suggests that EOQ can reduce total inventory costs where existing purchasing practices produce excess stock (By & Yamit, 2022). Within the present study, therefore, EOQ Model Application is conceptualised through order quantity optimisation and inventory cost management, since these capture both the quantity decision and its cost implications.

Order Quantity Optimisation

Order quantity optimisation concerns determining a replenishment quantity that provides sufficient inventory for operations while avoiding the financial and operational burdens associated with excessive or inadequate stock. It is essentially a balancing problem. Larger orders may lower the frequency and administrative cost of purchasing but increase average inventory, storage requirements and capital commitment. Smaller orders reduce the quantity held at any particular time but require more frequent replenishment and may expose the organisation to interruptions where suppliers or delivery schedules are unreliable. Contemporary EOQ optimisation consequently seeks a quantity that produces the most favourable overall inventory outcome rather than merely the lowest purchasing price. Azimian and Aouni (2025) demonstrated that multi-item order quantity decisions become more complicated under uncertain operating conditions because organisations must reconcile cost objectives with constraints and managerial preferences.

In the context of Training Heights Limited, order quantity optimisation concerns whether replenishment volumes correspond reasonably with operational consumption and available resources. Consider, for instance, an item consumed regularly by the organisation. Ordering several months' requirement merely because the supplier offers a temporary quantity discount may reduce the purchase price per unit while creating storage and liquidity costs that outweigh the saving. Conversely, repeatedly purchasing very small quantities could increase transportation and transaction costs and leave operations vulnerable to delayed replenishment. Quantity decisions therefore have consequences for both cost efficiency and inventory availability. This relationship becomes even less straightforward where demand or supplier lead time varies, since probabilistic demand and changing lead times can produce either shortages or excessive inventory if ordering policies remain rigid (Parkhan et al., 2024). The relevance of order quantity optimisation in this

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study consequently lies in how well Training Heights Limited balances these competing outcomes under actual supply conditions.

Inventory Cost Management

Inventory cost management describes the systematic control of costs generated by acquiring, ordering, holding and replenishing inventory. The cost of inventory extends considerably beyond the amount appearing on a supplier's invoice. Organisations incur administrative and transportation costs when orders are placed; storage requires space, security and handling; inventory ties down funds that could have been used elsewhere; and shortages may generate emergency purchases, operational delays or lost service opportunities. The economic logic of inventory management is therefore not to minimise one cost component in isolation, but to manage the trade-offs among them. EOQ models remain relevant precisely because reducing ordering frequency may increase holding costs, while aggressively reducing stock may increase ordering or shortage costs. Contemporary EOQ research continues to frame optimal replenishment as a total-cost problem rather than a simple purchasing exercise (Fallahi et al., 2022).

For Training Heights Limited, effective inventory cost management would mean knowing which costs are created by its ordering choices and managing them jointly. A purchasing decision that seems inexpensive at the point of acquisition could ultimately become costly if excess items remain unused for lengthy periods. Equally, maintaining extremely low stocks to avoid carrying costs may be economically misleading if repeated emergency procurement follows. Chang et al. (2024) demonstrated that inventory decisions interact with firms' cost structures under demand uncertainty, suggesting that inventory and cost choices cannot reasonably be separated from the environment within which demand occurs. Accordingly, inventory cost management represents an important dimension of EOQ application in this study because the financial value of the model for Training Heights Limited ultimately depends on whether ordering decisions help the organisation control total inventory-related expenditure without undermining the availability of required items.

Concept of Operational Performance

Operational performance describes how effectively an organisation converts its resources and operating processes into dependable outcomes. Although organisational performance can be evaluated through financial indicators such as profit or return on investment, operational performance focuses more immediately on what happens within the organisation's routine activities. It encompasses the ability to control cost, maintain required resources, respond to operational needs, deliver consistently and minimise disruptions. In supply-chain settings, performance is therefore closely associated with the quality of decisions governing purchasing, inventory, replenishment and resource utilisation. Recent research has continued to connect inventory management practices with operational outcomes because inventory is positioned between resource acquisition and the continuity of organisational activity (Srivastava et al., 2024).

For Training Heights Limited, operational performance is viewed from the narrower perspective of how effectively its inventory decisions support routine organisational requirements. This distinction matters. A large stock balance does not necessarily indicate good performance, because the organisation may simply be carrying unnecessary inventory. Likewise, a reduction in inventory expenditure is not automatically an improvement if frequently required items become unavailable. Operational performance therefore involves achieving a workable balance between efficiency and reliability. In the present study, this balance is represented by cost efficiency and inventory availability. The two dimensions capture an underlying managerial tension: Training Heights Limited must seek to control the resources consumed by inventory while retaining sufficient stock to prevent avoidable operational interruption.

Cost Efficiency

Cost efficiency refers to an organisation's ability to achieve required operational outputs while avoiding

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unnecessary expenditure or waste. Within inventory management, cost efficiency means more than obtaining goods at the lowest unit price. It reflects whether ordering frequency, replenishment quantities, carrying costs, transportation expenses, storage commitments and shortage-related costs are proportionate to the operational value obtained from inventory. A firm may negotiate a cheaper unit price by purchasing a large quantity, for example, yet become less cost-efficient once additional storage, handling and tied-up capital are considered. This is why contemporary inventory research frequently evaluates policies using overall operating or inventory costs rather than purchase price alone. Vicente et al. (2025), for instance, approached inventory planning under uncertainty as a problem involving both operating-cost minimisation and optimal replenishment decisions.

Applied to Training Heights Limited, cost efficiency represents the extent to which inventory resources are acquired and maintained without avoidable financial burden. Order quantity optimisation may contribute to this outcome when the firm reduces unnecessarily frequent orders or excessive stock accumulation. Inventory cost management may equally support efficiency by making procurement decisions sensitive to the full cost of carrying inventory rather than only the immediate acquisition cost. Yet the relationship cannot simply be assumed to remain constant. If a supplier becomes unreliable or demand changes unexpectedly, a quantity that initially minimised cost may require urgent adjustment. Cost efficiency in this study is consequently treated as an operational outcome that may arise from sound EOQ application, while recognising that the strength of that relationship could depend on supply-chain conditions.

Inventory Availability

Inventory availability concerns the organisation's ability to have required items accessible in sufficient quantity when they are needed for operations. Availability does not imply holding the maximum possible stock. Rather, it reflects the capacity to prevent avoidable shortages while keeping inventory within economically reasonable limits. This distinction becomes particularly relevant where demand and replenishment lead times fluctuate. Parkhan et al. (2024) observed that inventory control under probabilistic demand and lead time seeks to reconcile minimal inventory costs with adequate service levels, demonstrating that availability and efficiency are interdependent rather than competing objectives that can be managed independently.

For Training Heights Limited, insufficient inventory availability could interrupt routine activities, delay service delivery or force unplanned purchases, whereas excessive availability could indicate idle stock and unnecessary capital commitment. The desirable position therefore lies somewhere between shortage and excess. EOQ-related ordering decisions may help establish this balance by linking replenishment quantities more systematically to expected usage. Nevertheless, uncertainty remains central. Vicente et al. (2025) showed that demand uncertainty complicates inventory planning and creates a need for policies that determine both replenishment quantities and timing while preserving suitable service levels. Inventory availability in the present study consequently captures whether Training Heights Limited's ordering decisions translate into dependable access to required inventory, rather than merely producing large quantities of stock.

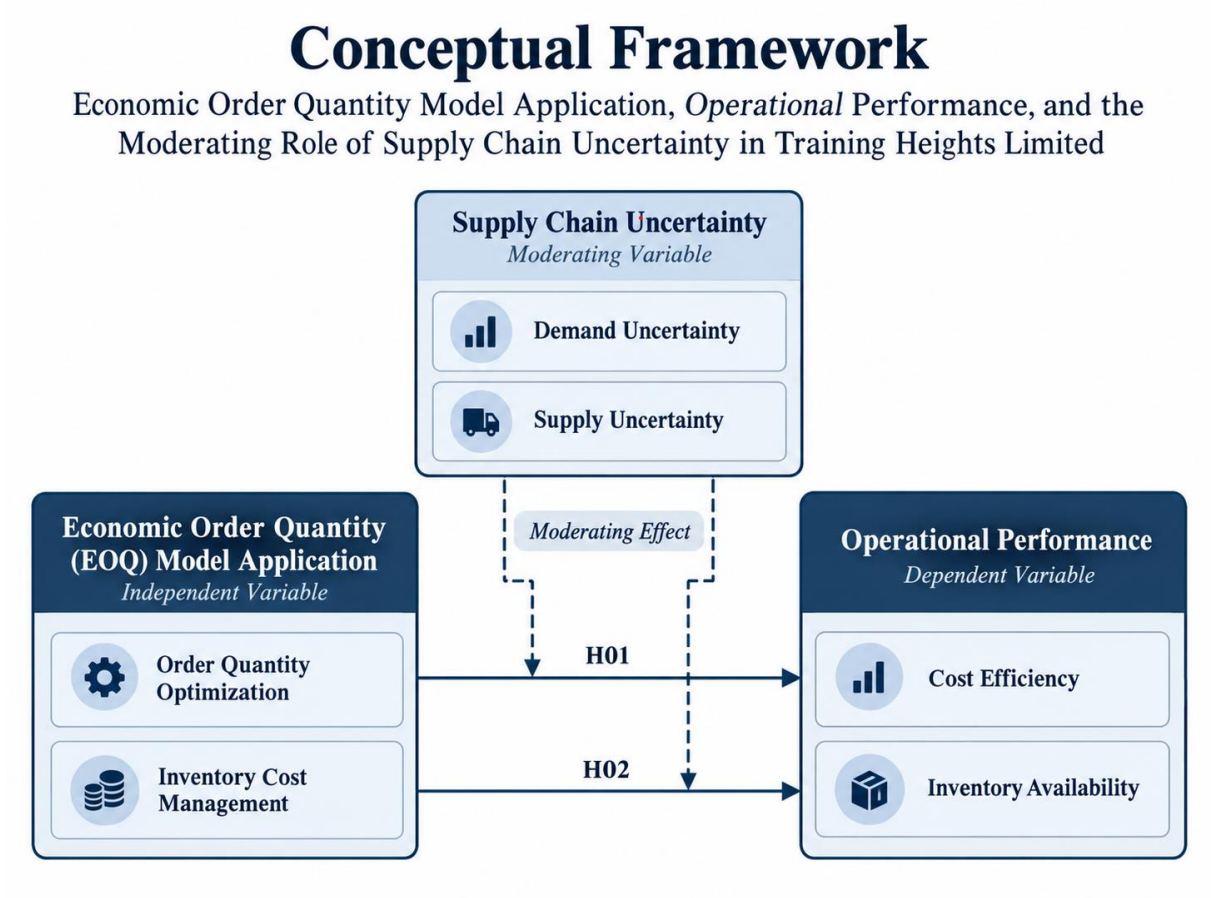
Supply Chain Uncertainty

Supply chain uncertainty describes the inability of an organisation to predict supply-chain conditions with sufficient precision for routine planning. It may originate from the demand side, where the quantity or timing of requirements changes unexpectedly, or from the supply side, where suppliers fail to deliver the expected quantity, quality or timing. Uncertainty may also arise through changing lead times, transportation interruptions, price variability and broader market disturbances. Unlike a known risk to which a probability can reasonably be assigned, uncertainty frequently leaves managers making decisions with incomplete knowledge about future conditions. This matters greatly for inventory management because conventional replenishment models typically operate more comfortably where demand and supply parameters are relatively stable. Yassine (2022/2023) illustrated this difficulty by examining inventory planning where a primary supplier could deliver less than the quantity ordered, while Chang et al. (2024) showed that demand

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uncertainty influences the trade-offs organisations make between inventory holdings and cost structures. The user's reference document similarly identifies supplier uncertainty, probabilistic demand, variable lead time and uncertain inventory decisions as recurring issues in contemporary inventory research.

Within Training Heights Limited, supply-chain uncertainty is particularly relevant because it can disturb the assumptions on which an apparently efficient order quantity was calculated. Suppose a particular quantity represented the firm's lowest-cost replenishment decision under normal demand and a predictable delivery interval. If supplier lead time suddenly lengthened, the same quantity could become insufficient before the next order arrived. If demand weakened unexpectedly, however, that quantity could generate excessive inventory. This illustrates why uncertainty may function as a moderating variable rather than merely another direct predictor of performance. It may change how strongly order quantity optimisation and inventory cost management translate into cost efficiency and inventory availability. Recent supply-chain research supports this contingent reasoning, with Srivastava et al. (2024) finding that supply uncertainty altered the performance consequences of supply-chain capabilities, while Yu et al. (2024) similarly found that the operational value of different inventory-oriented configurations varied according to the magnitude of supply-chain shocks. Thus, the present study treats uncertainty as a condition capable of changing the effectiveness of EOQ application rather than as a peripheral environmental issue.



The conceptual framework illustrates the relationship between Economic Order Quantity (EOQ) Model Application and Operational Performance in Training Heights Limited, with Supply Chain Uncertainty serving as a moderating variable. EOQ Model Application is represented by order quantity optimization and inventory cost management, while operational performance is measured through cost efficiency and inventory availability. The framework proposes that effective order quantity optimization can improve cost efficiency, while sound inventory cost management can enhance inventory availability. However, these relationships may be strengthened or weakened by supply chain uncertainty, reflected in demand and supply fluctuations. Thus, the framework provides the basis for examining both the direct effects of EOQ practices on operational performance and the moderating influence of uncertainty within the supply chain.

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THEORETICAL FRAMEWORK

Contingency Theory

This study is anchored on Contingency Theory, commonly traced in organisational scholarship to Paul Lawrence and Jay Lorsch in 1967. The theory developed against universalistic assumptions that one management arrangement, organisational structure or practice could perform best in every environment. Its central proposition is comparatively straightforward: organisational effectiveness depends on achieving an appropriate fit between managerial practices and the conditions confronting the organisation. Contemporary operations scholarship continues to use this reasoning to explain why the effectiveness of an operational practice may change across contexts. For example, Nenavani and Jain (2023) applied contingency reasoning to uncertainty and operational performance in supply chains, while Srivastava et al. (2024) explicitly examined supply uncertainty as a contextual condition affecting operational-performance relationships.

The major assumption of Contingency Theory is therefore that there is no universally superior organisational practice independent of context. Performance emerges from alignment, or fit, between an organisational choice and relevant internal or external conditions. Recent operations-management research describes this logic as requiring practices to be aligned with the environment if targeted performance outcomes are to be realised (Sousa et al., 2024). This assumption is especially useful for inventory research because practices designed around efficiency can produce different results as environmental volatility changes. Yu et al. (2024), for example, found that the operational effects of just-in-time and just-in-case configurations differed under varying levels of upstream and downstream supply-chain shocks. Such evidence challenges any expectation that a single inventory approach should perform equally well regardless of environmental conditions.

The theory nevertheless has limitations. Its idea of “fit” can become overly broad because almost any performance variation may subsequently be explained by referring to context. Determining which contingency matters, how much it matters and when misalignment becomes consequential is often difficult. There is also a danger of presenting organisations as if managers merely adapt rationally to external conditions, whereas actual inventory decisions may be influenced by imperfect information, resource constraints, supplier power and managerial judgement. Contextual factors may interact rather than operate separately, making simple contingency relationships inadequate for some supply-chain environments. Recent research partly responds to this criticism by empirically modelling contextual variables as moderators rather than treating environmental fit as an abstract proposition (Srivastava et al., 2024; Yu et al., 2024).

Despite this criticism, the principal strength of Contingency Theory lies in its rejection of a one-size-fits-all view of management. This flexibility is particularly valuable for operations and supply-chain studies, where practices that work efficiently under predictable demand may become inappropriate when supply becomes unstable. Nenavani and Jain (2023) used the theory to explain the relationship among uncertainty, responsiveness and operational performance, while contemporary research has employed contingency arguments to examine how contextual factors alter the effectiveness of operational capabilities and management practices. The theory therefore allows an investigation to move beyond asking whether a practice “works” and instead ask the more realistic question of under what conditions it works more or less effectively.

Applied to the present study, this reasoning provides a direct theoretical explanation for the proposed moderating role of supply-chain uncertainty. Order quantity optimisation and inventory cost management constitute inventory-management practices adopted by Training Heights Limited, while cost efficiency and inventory availability represent the expected operational outcomes. A purely universalistic interpretation of EOQ would imply that better application should consistently produce superior operational performance. Contingency Theory suggests a more qualified relationship. Where demand and supply conditions are comparatively predictable, EOQ-based quantities may align reasonably well with actual inventory requirements. Under substantial demand fluctuations, supplier unreliability or changing lead times, however,

fixed ordering assumptions may become less appropriate, altering the extent to which EOQ practices generate cost efficiency and inventory availability. Supply-chain uncertainty therefore represents the environmental contingency in the framework, while EOQ application represents the managerial practice whose effectiveness is expected to depend partly on that contingency. This theoretical fit makes Contingency Theory particularly suitable for explaining the two moderating relationships proposed in the study.

EMPIRICAL REVIEW

Sremac et al. (2018) investigated the development of an Adaptive Neuro-Fuzzy Inference System (ANFIS) model for determining economic order quantity in complex logistics processes where the relationships among inventory variables could not easily be established through conventional analytical methods. The study was undertaken using operational information from an observed company and expert knowledge relating to a selected group of inventory items, although the specific geographical location and identity of the company were not disclosed in the published article. Methodologically, the research adopted a modelling and computational design rather than a conventional survey design; consequently, a human population, survey sample size and probability sampling technique were not applicable. The researchers used secondary operational information from the company together with expert judgement as the principal sources of data and developed an ANFIS model that combined fuzzy logic with artificial neural networks. The validity of the resulting model was evaluated using average relative error, while sensitivity analysis was conducted to determine the stability of the model under changes in its parameters. The findings indicated that the ANFIS model reproduced expert EOQ decisions with a high degree of accuracy and remained sufficiently robust under sensitivity testing. The researchers consequently proposed the model as a flexible decision-support approach that could be adapted to different categories of goods within supply-chain management. However, the study was limited by its reliance on information from one observed organisational setting and a specific group of items, while its modelling orientation meant that wider organisational performance outcomes such as cost efficiency and inventory availability were not empirically investigated.

Tziora et al. (2026) examined how different forms of supply uncertainty influenced inventory decisions within EOQ-based inventory systems and sought to provide a unified analytical treatment of uncertainties associated with random yield, random quality, random supplier capacity and supply disruption. The study was not geographically restricted to a particular organisation or country because it employed theoretical inventory models rather than field observations. Its design was analytical and mathematical; therefore, no organisational population, sample size, sampling procedure or questionnaire-based data collection was involved. The researchers formulated EOQ and ((s,S))-type inventory models and developed a common long-run average cost framework for the four identified forms of supply uncertainty. They subsequently determined cost-minimising inventory policies and conducted theoretical and numerical comparisons to assess changes in total inventory cost, optimal policy parameters and replenishment intervals. The findings demonstrated that different manifestations of supply uncertainty generated distinct effects on inventory decisions and that treating all supply uncertainty as a single homogeneous phenomenon could produce inappropriate replenishment choices. The analysis therefore suggested that managers should incorporate the specific form and severity of supplier uncertainty when evaluating suppliers and determining inventory policies. A limitation arising from the study's design was that its conclusions were derived primarily from stylised mathematical assumptions and numerical analysis rather than organisational data, leaving room for empirical validation of how supply uncertainty alters EOQ-performance relationships in actual firms.

Chen et al. (2023) systematically reviewed the application of uncertainty analysis and optimisation modelling to supply-chain management with the objective of identifying dominant uncertainties, modelling approaches, research patterns and future directions in the field. The study had an international rather than single-country geographical scope because the reviewed publications originated from several countries and international journals. A systematic literature review and bibliometric research design was adopted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework. The review population initially consisted of 6,591 academic records retrieved from the Web of Science database, which were progressively screened for duplication, relevance and eligibility; the final sample comprised 121 articles from 44 international academic journals published between 2015 and 2022. Selection was purposive and

criterion-based rather than probabilistic because articles were retained according to predefined inclusion and exclusion requirements. Secondary data obtained from published academic literature constituted the data source, while PRISMA procedures, bibliometric analysis and CiteSpace software were employed for data collection, classification and analysis. The findings showed that uncertainty analysis and optimisation had been extensively employed in supply-chain decision making and identified demand uncertainty, supply uncertainty, operating-cost uncertainty, risk and disruption as major sources of instability. The authors recommended extending future work towards supply-chain resilience, emergency and security management, behavioural factors, artificial intelligence and big-data applications. They acknowledged that their review had been restricted mainly to Web of Science journal publications and excluded textbooks, dissertations, unpublished works and potentially relevant studies outside the database, thereby limiting the comprehensiveness of the evidence base.

Yan (2023) investigated the role played by order quantity in supply chains exposed to demand uncertainty, supply uncertainty, or both simultaneously and further examined how these uncertainty conditions affected the design of quantity-based coordinating contracts. The study did not focus on a particular geographical location because it employed a theoretical supply-chain setting consisting of one supplier and one buyer. An analytical modelling design was adopted, meaning that a survey population, respondents, sample size and sampling technique were not applicable. Data in the conventional empirical sense were not collected; instead, the researcher specified stochastic demand and supply-yield distributions, constructed centralised and decentralised supply-chain models and used mathematical derivations complemented by numerical examples to analyse optimal ordering behaviour and contract coordination. The findings showed that, under demand uncertainty alone, order quantity operated as a hedging mechanism in both centralised and decentralised systems, whereas under supply uncertainty it served as a hedging mechanism primarily within the decentralised arrangement. Supply uncertainty was also found to complicate quantity-based supply-chain coordination more strongly than demand uncertainty, and the combined demand-and-supply uncertainty model displayed patterns similar to those obtained under supply uncertainty alone. The managerial implication was that order quantities and coordinating contracts needed to be adjusted according to the source of uncertainty rather than applying a uniform ordering rule across uncertain environments. Nevertheless, because the analysis relied on a stylised one-supplier, one-buyer structure and theoretical distributional assumptions, its applicability to more complex real organisations, multiple suppliers and organisation-level measures of operational performance remained limited and required empirical investigation.

Thomas and Kumar (2022) developed a fuzzy EOQ model that incorporated inspection errors into a single-sampling inventory system in order to determine economically appropriate ordering decisions where item quality and inventory parameters were uncertain. The investigation was conducted as a mathematical study at the National Institute of Technology Calicut, India, although the inventory system itself was hypothetical rather than an empirical study of a particular Indian organisation. Accordingly, the research employed an analytical modelling design, and conventional elements such as a population, respondent sample, sampling technique and primary questionnaire data were not applicable. The researchers assumed that received orders were subjected to acceptance sampling, that defective items were separated from usable inventory and that misclassification could occur during inspection. Holding costs, back-order costs and the rate at which items became scrap were represented using fuzzy random variables. The model maximised expected total profit, and numerical examples together with sensitivity analysis were used to test its behaviour and validity. The results indicated that incorporating inspection errors and fuzzy uncertainty could produce more realistic EOQ decisions where quality information was imperfect, while sensitivity analysis supported the validity of the developed formulation. The study therefore implied that managers facing imperfect-quality inventory should account for inspection errors and uncertainty when determining economic order quantities rather than relying exclusively on deterministic EOQ assumptions. Its major limitation was its dependence on hypothetical numerical examples and specified mathematical assumptions, with no organisational sample through which the model's effect on actual cost efficiency or inventory availability could be established.

Khalilpourazari et al. (2019) developed a multi-item EOQ model that incorporated defective supply batches, random disruptions and partial backordering under uncertain conditions, with the objective of minimising

total inventory cost while identifying optimal inventory decision variables. The study was not geographically delimited to a specific company or country because it was formulated as a general mathematical inventory problem. It adopted an operations-research modelling design rather than a survey design; hence, no human population, sample size or sampling technique was specified. The researchers relied on hypothetical and numerical inventory parameters as their source of analytical data and formulated two alternative optimisation approaches, namely Basic Chance Constraint Programming and Robust Fuzzy Chance Constraint Programming, to represent uncertain inventory parameters. The performance of the competing models was examined through a numerical example, after which sensitivity analysis was used to establish how changes in key parameters affected the objective function. The results indicated that the Robust Fuzzy Chance Constraint Programming model generated more risk-averse inventory solutions than the basic chance-constraint formulation, suggesting that EOQ decisions under disruption and defective supply could benefit from models that explicitly incorporated uncertainty. The researchers consequently demonstrated the usefulness of robust-fuzzy modelling for managers requiring protection against unfavourable inventory outcomes. A design-based limitation, however, was that model performance was demonstrated mainly through numerical experimentation rather than primary organisational evidence, thereby restricting direct conclusions concerning employee-based or firm-level operational performance.

Kagganty et al. (2024) examined stochastic profit optimisation in an agile two-tier supply chain and sought to develop a decision framework that could improve supplier selection and order allocation under demand and supply uncertainty. The work was presented at the 8th International Conference on Computational System and Information Technology for Sustainable Solutions in Bengaluru, India, although the model itself was not restricted to an identified business organisation or geographical supply chain. The study employed a stochastic mathematical and simulation design; consequently, there was no conventional survey population, respondent sample or sampling technique. Rather than collecting questionnaire responses, the researchers modelled supply-chain scenarios incorporating uncertain supply and demand, defective items, quantity discounts and buy-back arrangements. Monte Carlo simulation was used to represent stochastic outcomes, while a Markov Decision Process was applied to support sequential decision making and profit optimisation across alternative states. The reported findings suggested that the framework could guide more efficient supplier selection and order allocation while improving profitability, operational efficiency and customer-related outcomes under uncertainty. The study proposed the approach as a basis for more resilient and adaptive supply-chain decisions. A particularly relevant limitation was that the model had not yet been validated against the operating parameters of a specific real-world company; indeed, the authors identified application to an actual business environment as an avenue for subsequent work, meaning that its practical stability and external validity still required field-based confirmation.

Yassine (2022) investigated inventory planning under supplier uncertainty in a two-level supply chain with the objective of determining an optimal ordering policy where the manufacturer's principal supplier was unreliable and could deliver less than the quantity originally ordered. The study was developed as a general supply-chain model rather than being geographically confined to an identified company, although the author was affiliated with Beirut Arab University in Lebanon. A mathematical optimisation design was employed using a hypothetical two-level supply chain comprising one manufacturer and two suppliers. Supplier A represented the unreliable primary supplier whose delivered quantity was stochastic, whereas Supplier B represented a more expensive but reliable secondary supplier that could provide reserved emergency quantities. Since the research was model-based, a conventional study population, sampling frame, sample size and sampling technique were not applicable, nor were questionnaire or interview data collected. The researcher mathematically formulated the production-inventory problem, derived an expected total cost per unit-time function and obtained optimal solutions by solving a system of nonlinear equations that minimised the expected total cost. The findings established an optimal ordering mechanism through which the manufacturer could combine the relatively inexpensive but uncertain primary source with the reliable secondary source to manage disruption risk. Yassine consequently proposed the model as a decision-support mechanism for supply-chain managers seeking alternative sourcing arrangements under supplier uncertainty. However, the simplified two-supplier structure and analytical assumptions limited direct generalisation to

more complex multi-supplier networks and did not empirically examine whether the proposed inventory policy translated into actual operational performance within an organisation.

Vicente et al. (2025) examined inventory planning in multi-echelon supply chains under demand uncertainty with the objective of comparing alternative inventory-review policies and determining the policy that could minimise overall operating costs while providing an appropriate replenishment plan. The study employed a real-world multi-stage supply-chain case study, although the accessible published abstract did not disclose a specific geographical location for the case organisation; the researchers themselves were based at the University of Lisbon, Portugal. A case-based mathematical optimisation design was adopted rather than a cross-sectional survey. Accordingly, no human population, respondent sample size or probabilistic sampling technique was reported. Operational supply-chain case data were used to formulate and test three multi-period inventory models incorporating inventory levels and flows among facilities. Demand uncertainty at retailer level was incorporated by determining safety stock capable of satisfying specified service levels, while a guaranteed-service approach represented time delays within distribution flows. The models were compared according to operating costs, replenishment quantities, replenishment timing, inventory levels and service requirements. The findings indicated that combining inventory planning with explicit review policies improved the quality of operational decisions and enabled decision makers to choose an appropriate inventory policy according to prevailing supply-chain conditions; the study also emphasised the significant role of lead time, which earlier modelling work had frequently neglected. The researchers therefore advocated closer integration of inventory planning, replenishment timing, safety-stock decisions and policy selection. Nevertheless, the empirical demonstration relied on a single real-world case and a specific multi-echelon configuration, which restricted broad generalisation and created a need for additional organisational evidence across different operating and uncertainty environments.

Literature Gap

The reviewed literature revealed clear theoretical, methodological, contextual and empirical gaps that justified the present study. Existing studies had largely concentrated on developing mathematical, computational and simulation-based inventory models for determining optimal order quantities and managing uncertainty, rather than establishing how Economic Order Quantity Model application translated into measurable operational performance within actual organisations. For instance, Sremac et al. (2018), Thomas and Kumar (2022), Yan (2023), Khalilpourazari et al. (2019), and Tziora et al. (2026) relied predominantly on analytical models, hypothetical scenarios and numerical experimentation, thereby providing limited organisation-level evidence on outcomes such as cost efficiency and inventory availability. Similarly, although Chen et al. (2023), Yassine (2023), Kagganty et al. (2024), and Vicente et al. (2025) demonstrated that demand uncertainty, supplier unreliability, disruptions and variable lead times could influence inventory decisions, they did not specifically examine whether supply chain uncertainty moderated the relationship between EOQ Model application and operational performance. A further contextual gap existed because much of the available evidence originated from theoretical settings, international supply chains or non-Nigerian contexts, leaving limited empirical evidence from Nigerian organisations, particularly firms operating in Abuja. In addition, previous research rarely decomposed EOQ Model application into order quantity optimisation and inventory cost management while simultaneously assessing operational performance through cost efficiency and inventory availability. The present study therefore addressed these gaps by empirically examining these specific relationships in Training Heights Limited, Abuja, while introducing supply chain uncertainty as a moderating variable capable of strengthening or weakening the effect of EOQ Model application on operational performance.

METHODOLOGY

The study adopted a cross-sectional survey research design to examine the relationships between employees' perceptions of EOQ-related inventory management practices, operational performance and supply chain uncertainty in Training Heights Limited, Abuja. The study population comprised 205 employees, all of whom were included in the sampling frame through a census approach. Primary data were collected using a structured five-point Likert-scale questionnaire, of which 188 valid responses were retained for analysis. The

independent variables, order quantity optimisation and inventory cost management, were operationalised through employees' assessments of the organisation's inventory management practices. Similarly, cost efficiency and inventory availability were measured using respondents' perceptions of operational performance, while supply chain uncertainty reflected their assessments of prevailing demand and supply-related uncertainties. The study did not utilise actual inventory transaction records, ordering costs, holding costs, demand quantities or mathematically calculated EOQ values. Consequently, the term EOQ-related practices refers to the theoretical inventory management principles underlying the study constructs rather than confirmed implementation of the EOQ mathematical model. Hierarchical moderated regression analysis was conducted using IBM SPSS Statistics version 27 to evaluate the hypothesised relationships and moderating effects. The resulting coefficients were interpreted as statistical associations rather than evidence of causality or objectively measured operational improvements, guided by the empirical model specifications: Model 1 for Hypothesis One ($CE = \beta_0 + \beta_1 OQO + \beta_2 SCU + \beta_3 (OQO \times SCU) + \varepsilon$) and Model 2 for Hypothesis Two ($IA = \beta_0 + \beta_1 ICM + \beta_2 SCU + \beta_3 (ICM \times SCU) + \varepsilon$), where CE represented cost efficiency, OQO denoted order quantity optimization, IA signified inventory availability, ICM reflected inventory cost management, SCU designated supply chain uncertainty, $OQO \times SCU$ and $ICM \times SCU$ were the respective interaction terms, β_0 denoted the intercept, β_1 to β_3 were regression parameters, and ε was the stochastic disturbance term.

Variable	Construct Dimension	Number of Items	Cronbach's Alpha (α)	Decision / Internal Consistency
Independent Variable (EOQ)	Order Quantity Optimization (OQO)	5	0.846	Highly Reliable ($\alpha > 0.70$)
	Inventory Cost Management (ICM)	5	0.824	Highly Reliable ($\alpha > 0.70$)
Dependent Variable (Operational Performance)	Cost Efficiency (CE)	5	0.861	Highly Reliable ($\alpha > 0.70$)
	Inventory Availability (IA)	5	0.835	Highly Reliable ($\alpha > 0.70$)
Moderating Variable	Supply Chain Uncertainty (SCU)	6	0.879	Highly Reliable ($\alpha > 0.70$)
Overall Instrument	Entire Measurement Scale	26	0.894	

Data Presentation And Analysis

Introduction

This chapter presents the empirical results of the data collected from the respondents at Training Heights Limited, beginning with an evaluation of the response rate and the demographic profile of the participants. Descriptive statistics, including mean and standard deviation, are utilized to summarize the core variables order quantity optimization, inventory cost management, cost efficiency, inventory availability, and supply chain uncertainty. Furthermore, inferential statistical tools, specifically hierarchical moderated regression analysis conducted via IBM SPSS Statistics version 27, are employed to test the direct and interaction effects specified in the study's hypotheses, thereby providing empirical evidence to address the research questions and objectives.

Table 2: Questionnaire Administration and Response Rate

Questionnaire Category	Frequency (n)	Percentage (%)
Administered / Distributed	205	100.00
Retrieved / Returned	194	94.63
Unretrieved / Not Returned	11	5.37
Unusable / Incompletely Filled	6	2.93
Usable / Valid for Analysis	**188**	**91.71**

Source: Field Survey, 2026)

Out of the 205 administered instruments, 194 copies were successfully retrieved, reflecting an initial retrieval rate of 94.63%. Following data screening for missing values, pattern marking, and incomplete responses, 6 copies were discarded as unusable. This left 188 completely filled and valid questionnaire for the final empirical analysis, representing a net usable response rate of 91.71%. This exceeds standard methodological benchmarks (typically $\geq 70\%$) for organizational surveys, ensuring sufficient statistical power for inferential modeling.

Table 2B: Descriptive Statistics and Zero-Order Correlation Matrix ($N = 188$)

Variable	Mean	SD	1	2	3	4	5
Order Quantity Optimisation (OQO)	3.68	0.62	1.000				
Inventory Cost Management (ICM)	3.74	0.58	.481*	1.000			
Supply Chain Uncertainty (SCU)	3.52	0.71	-.274*	-.289*	1.000		
Cost Efficiency (CE)	3.81	0.50	.612*	.425*	-.411*	1.000	
Inventory Availability (IA)	3.76	0.53	.398*	.578*	-.432*	.512*	1.000

Source: Field Survey, 2026)

Table 2B presented the descriptive statistics and zero-order correlations among the study variables. The mean scores ranged from 3.52 to 3.81, indicating generally favourable respondents' perceptions of the study constructs, while the standard deviations ranged from 0.50 to 0.71, suggesting relatively moderate variations in responses. Order quantity optimisation showed a positive correlation with cost efficiency (r = 0.612), while inventory cost management was positively correlated with inventory availability (r = 0.578). Conversely, supply chain uncertainty exhibited negative correlations with cost efficiency (r = −0.411) and inventory availability (r = −0.432). The findings implied that perceived improvements in order quantity optimisation and inventory cost management were associated with better operational performance in Training Heights Limited. However, higher perceived supply chain uncertainty was associated with lower cost efficiency and inventory availability. These relationships provided preliminary empirical support for the study's proposed associations and justified further examination of the moderating role of supply chain uncertainty through hierarchical moderated regression analysis.

Test of the Hypotheses

Hypothesis One

H_{o1}: Supply chain uncertainty does not significantly moderate the effect of order quantity optimization on cost efficiency in Training Heights Limited.

Model 1

$$CE = \beta_0 + \beta_1 OQO + \beta_2 SCU + \beta_3 (OQO \times SCU) + \varepsilon \ldots\ldots\ldots\ldots\ldots 1$$

Table 3 Model Summary[c]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.648[a]	.420	.414	.38142	.420	66.974	2	185	.000	
2	.692[b]	.479	.471	.36241	.059	20.852	1	184	.000	1.892
a. Predictors: (Constant), OQO, SCU										
b. Predictors: (Constant), OQO, SCU, (OQO×SCU)										
c. Dependent Variable: CE										

The Model Summary in Table 3 showed that introducing the interaction term $(OQO \times SCU)$ in Model 2 increased the correlation coefficient from $R = .648$ to $.692$, with the coefficient of determination rising

from $R^2 = .420$ to $.479$. This yielded a statistically significant incremental variance explained ($\Delta R^2 = .059$, $F\text{-change}_{(1,184)} = 20.852$, $p < .001$), alongside a Durbin-Watson statistic of 1.892 confirming the absence of serial autocorrelation. The empirical implication for Training Heights Limited was that supply chain uncertainty accounted for an additional 5.9% of the variation in cost efficiency beyond the standalone effects of order quantity optimization and uncertainty, demonstrating that external disruption meaningfully altered the cost gains derivable from calculated batch sizing.

Table 4 **ANOVA[a]**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.487	2	9.744	66.974	.000[b]
	Residual	26.915	185	.145		
	Total	46.402	187			
2	Regression	22.225	3	7.408	56.407	.000[d]
	Residual	24.177	184	.131		
	Total	46.402	187			

a. Dependent Variable: CE

b. Predictors: (Constant), OQO, SCU

C. Predictors: (Constant), OQO, SCU, (OQO×SCU)

Source: SPSS Output Version 27.0.1

The ANOVA results in Table 4 demonstrated that the moderated regression model was statistically significant overall across both baseline and interactive iterations, with Model 2 yielding $F_{(3,184)} = 56.407$ ($p < .001$) and a regression sum of squares of 22.225. This verified that the composite interaction of order quantity optimization and supply chain uncertainty possessed robust predictive validity over the error variance ($MS_{\text{residual}} = .131$). The practical implication for the organisation was that the structural regression model reliably captured changes in procurement and operating cost efficiencies, confirming that institutional performance was systematically influenced by the joint interplay of internal lot sizing and external logistics volatility rather than random chance.

Table 5 **Coefficients[a]**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Tolerance	
		B	Std. Error	Beta				VIF
1	(Constant)	3.712	.028		132.571	.000		
	OQO	.458	.043	.572	10.651	.000	.925	1.081
	SCU	-.184	.039	-.254	-4.718	.000	.925	1.081
3	(Constant)	3.754	.028		134.071	.000		
	OQO	.412	.042	.514	9.810	.000	.868	1.152
	SCU	-.205	.037	-.282	-5.541	.000	.894	1.119
	(OQO x SCU)	-.191	.042	-.248	-4.566	.000	.942	1.062

a. Dependent Variable: CE

Source: SPSS Output Version 27.0.1

The regression coefficients in Table 5 indicated that while order quantity optimization exerted a significant positive direct effect on cost efficiency ($B = .412$, $t = 9.810$, $p < .001$), the interaction term ($OQO \times SCU$) was negative and statistically significant ($B = -.191$, $t = -4.566$, $p < .001$, with VIF $= 1.062$ ruling out multicollinearity). Consequently, the null hypothesis (H_{01}) was rejected, confirming that supply chain uncertainty exerted a significant negative moderating effect. The operational implication for Training Heights Limited was that acute supplier delays, unpredictable demand, and price turbulence functioned as a buffering shock; heightened supply chain uncertainty significantly weakened the cost-saving benefits of standard order quantity optimization, necessitating dynamic safety stock policies rather than static lot-sizing formulas.

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Hypothesis Two

H_{02}: Supply chain uncertainty does not significantly moderate the effect of inventory cost management on inventory availability in Training Heights Limited.

Model 2

$$IA = \beta_0 + \beta_1 ICM + \beta_2 SCU + \beta_3 (ICM \times SCU) + \varepsilon \ldots\ldots\ldots\ldots\ldots 2$$

Table 6 **Model Summary[c]**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.612[a]	.375	.368	.40112	.375	55.405	2	185	.000	
2	.664[b]	.441	.432	.38045	.066	21.782	1	184	.000	1.944

a. Predictors: (Constant), ICM, SCU

b. Predictors: (Constant), ICM, SCU, (ICM×SCU)

c. Dependent Variable: IA

The Model Summary in Table 6 revealed that introducing the interaction term $(ICM \times SCU)$ in Model 2 enhanced the correlation coefficient from $R = .612$ to $.664$, while the coefficient of determination rose from $R^2 = .375$ to $.441$. This moderation effect accounted for an additional 6.6% of the variance explained in inventory availability, which proved statistically significant ($\Delta R^2 = .066$, $F\text{-change}_{(1,184)} = 21.782$, $p < .001$), alongside a Durbin-Watson statistic of 1.944 verifying the absence of residual autocorrelation. The empirical implication for Training Heights Limited was that supply chain uncertainty meaningfully conditioned the explanatory capacity of inventory cost controls on material readiness, demonstrating that storage cost containment alone could not fully account for stock fulfillment levels without factoring in external supply turbulence.

Table 7 **ANOVA[a]**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.828	2	8.914	55.405	.000[b]
	Residual	29.765	185	.161		
	Total	47.593	187			
2	Regression	20.981	3	6.994	48.320	.000[d]
	Residual	26.612	184	.145		
	Total	47.593	187			

a. Dependent Variable: IA

b. Predictors: (Constant), ICM, SCU
C. Predictors: (Constant), ICM, SCU, (ICM×SCU)

Source: SPSS Output Version 27.0.1

The ANOVA results in Table 7 established that the regression models were statistically significant at both the direct and moderated stages, with the interaction model yielding $F_{(3,184)} = 48.320$ $(p < .001)$ and an explained sum of squares of 20.981 against a residual variance of .145.

This confirmed that the joint combination of inventory cost management, supply chain uncertainty, and their interaction term was a reliable predictor of inventory availability rather than a product of sampling error. The practical implication for the organisation was that decisions targeting carrying-cost reduction and physical stock maintenance maintained a systematic, statistically validated link with operational stock availability across training cohorts.

Table 8		Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Tolerance	
		B	Std. Error	Beta				VIF
1	(Constant)	3.645	.030		121.500	.000		
	ICM	.431	.046	.539	9.370	.000	.918	1.089
	SCU	-.197	.042	-.268	-4.690	.000	.918	1.089
3	(Constant)	3.691	.029		127.276	.000		
	ICM	.388	.044	.485	8.818	.000	.871	1.148
	SCU	-.224	.040	-.305	-5.600	.000	.886	1.129
	(ICM x SCU)	-.206	.044	-.261	-4.667	.000	.947	1.056
a. Dependent Variable: AI								

***Source**: SPSS Output Version 27.0.1*

The regression coefficients in Table 8 showed that although inventory cost management maintained a significant positive direct effect on inventory availability ($B = .388$, $t = 8.818$, $p < .001$), the interactive term ($ICM \times SCU$) produced a negative and statistically significant coefficient ($B = -.206$, $t = -4.667$, $p < .001$, with a VIF of 1.056 ruling out multicollinearity). On this basis, the null hypothesis (H_{02}) was rejected, confirming that supply chain uncertainty significantly moderated the relationship in an antagonistic manner. The operational implication for Training Heights Limited was that acute supply chain uncertainty dampened the effectiveness of inventory cost management; when vendor deliveries stalled or demand fluctuated sharply, aggressive cost-cutting in inventory handling risked creating stockouts of vital course packs and technical materials, underscoring the need to balance cost containment with strategic safety buffers.

DISCUSSION OF FINDINGS

The finding for **H_{01}** showed that supply chain uncertainty significantly moderated the effect of order quantity optimisation on cost efficiency in Training Heights Limited, leading to the rejection of the null hypothesis. The negative interaction coefficient further suggested that although order quantity optimisation improved cost efficiency, rising supply chain uncertainty weakened this positive effect. This finding agreed with Tziora et al. (2026), who established that different forms of supply uncertainty altered EOQ-based inventory decisions and cost outcomes, and with Yan (2023), who found that order quantity decisions behaved differently under demand and supply uncertainty. It was also consistent with Chen et al. (2023), who identified uncertainty as a major factor affecting supply-chain optimisation, and Khalilpourazari et al. (2019), who demonstrated that disruption and uncertainty changed optimal EOQ decisions. Similarly, Kagganty et al. (2024) showed that uncertain supply and demand conditions influenced order allocation and profitability. However, the finding partly contrasted with Sremac et al. (2018), whose EOQ modelling emphasised optimisation accuracy without directly establishing a moderating effect of uncertainty on cost efficiency, and Thomas and Kumar (2022), whose fuzzy EOQ model focused mainly on inspection errors rather than organisational cost-efficiency outcomes. These studies did not directly antagonise the present result; rather, they addressed narrower modelling contexts. The result was also supported by Contingency Theory, which held that the effectiveness of a managerial practice depended on prevailing environmental conditions. In this study, supply chain uncertainty acted as the contingency that reduced the extent to which order quantity optimisation translated into cost efficiency.

For **H_{02}**, the analysis revealed that supply chain uncertainty significantly moderated the effect of inventory cost management on inventory availability, resulting in the rejection of the null hypothesis. The negative interaction coefficient indicated that effective inventory cost management improved inventory availability, but this benefit declined as supply chain uncertainty increased. The result supported Yassine (2022), who showed that supplier uncertainty affected inventory planning and required firms to alter sourcing and

ordering decisions to maintain availability. It also aligned with Vicente et al. (2025), who found that inventory planning under uncertainty required adjustments in replenishment quantities, timing and safety-stock decisions, and with Tziora et al. (2026), who established that uncertainty affected inventory policy parameters and replenishment behaviour. Chen et al. (2023) similarly recognised supply and demand uncertainty as major sources of instability in inventory systems, while Yan (2023) demonstrated that uncertainty changed the role of order quantity in supply-chain coordination. In contrast, Sremac et al. (2018) and Thomas and Kumar (2022) concentrated mainly on EOQ optimisation and fuzzy modelling and did not directly examine inventory availability as a performance outcome. Their findings therefore did not fundamentally contradict the present study but offered limited empirical comparison on the moderating relationship. Consistent with Contingency Theory, the result suggested that inventory cost management did not produce uniform outcomes under all conditions; rather, its effectiveness in sustaining inventory availability depended on the level of supply chain uncertainty confronting Training Heights Limited.

CONCLUSION AND RECOMMENDATIONS

The study concluded that perceived EOQ-related inventory management practices were positively associated with perceived operational performance in Training Heights Limited, Abuja. Specifically, employees' assessments of order quantity optimisation were positively related to cost efficiency, while inventory cost management was positively associated with inventory availability. However, supply chain uncertainty significantly weakened both relationships, highlighting the importance of environmental conditions in inventory management outcomes. Consistent with Contingency Theory, the findings suggest that the relationship between inventory management practices and operational performance depends partly on prevailing supply chain conditions. Since the analysis relied on employee-reported questionnaire data rather than actual inventory records or EOQ calculations, the findings do not establish the quantitative effectiveness of implementing the EOQ mathematical model.

1. Training Heights Limited should strengthen its inventory planning and ordering practices through periodic reviews of demand patterns, procurement procedures and supplier reliability to improve perceived cost efficiency under uncertain operating conditions.

2. Management should improve inventory cost monitoring, supplier coordination and replenishment planning while introducing objective inventory performance indicators to evaluate inventory availability and assess the practical benefits of EOQ-based inventory decisions.

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