International Journal of Management and Business Research

Volume 7, Issue 1, pg. 255-271, 2025 *ISSN 29769-91723*

IJMBR https://grandmarkpublishers.com/index.php/IJMBR/index

DEMAND VISIBILITY AND PERFORMANCE OF LEVEL 4 PRIVATE HOSPITALS IN KENYA

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ABSTRACT

Healthcare system in Kenya is still a national challenge, five decades after independence. Accountability and transparency on the utilization of health resources is also a major issue and as a result, ministry of health is the second most corrupt ministry in Kenya and the health department in the county governments is the department most perceived to be prone to corruption. Therefore, the study sought to find out the effect of demand visibility on performance of level 4 private hospitals in Kenya. The study also sought to establish the moderating effect of technology adoption on the relationship between demand visibility and performance of level 4 private hospitals in Kenya. The study was anchored on Knowledge-Based Theory and Technology Acceptance Model (TAM). The study adopted cross-sectional research design and positivist research paradigm. The unit of analysis was the 368 level 4 private hospitals in Kenya while the unit of observation was heads of procurement, quality assurance, finance, risk and compliance and audit. Therefore, the target population was 1840 heads of departments in level 4 private hospitals in Kenya. Krejcie and Morgan (1970) formula was adopted in calculating appropriate sample size. From the formula, the sample size for the study was 320 respondents. The sample was selected using stratified random sampling. The study used primary data collected using semi-structured questionnaires. The study collected both qualitative and quantitative data, Qualitative data was analysed using content analysis a presented in prose form. Quantitative data was analysed using SPSS version 28. Descriptive statistics including means, percentages, frequencies and standard deviations were used to analyse quantitative data. Inferential statistics using Pearson R correlation, simple regression and multiple regressions were also computed. The study concludes that demand visibility positively and significantly influences with performance of private hospitals in Kenya. The study also concludes that technology adoption has significant moderating effect on the relationship between demand visibility and performance of private hospitals in Kenya. Based on the findings, the study recommends private hospitals to implement advanced demand forecasting and inventory management systems to improve demand visibility and optimize their inventory management processes. These systems can help hospitals anticipate patient needs more accurately, reduce waste, and enhance overall performance.

Key Words: Demand Visibility, Technology Adoption, Level 4 Private Hospitals

Background of the Study

In the age of competition, no industry can survive without pondering much about reducing expenditures wherever possible (Shiau, Dwivedi, & Tsai, 2020). The same is true for health care industry, which is witnessing sharp rise in price in almost all its products and services. The alarmingly high pace of upward movement of cost is making the produce of the industry beyond the reach of the mass (Christopher, 2021). Supply chain in this industry being a significant driver of cost is therefore grabbing all the attention from industry stakeholders.

It is therefore substantial for health care industries to enforce and seek out new strategies regarding supply chain management to endure within the current competitive and capricious business climate which is critical (Paulraj, Chen, & Lado, 2019). A concept of visibility represents a beneficial role among business partners such as manufacturers, supplier, and customers. The categorization of several types for uncertainties in the supply chain such as demand, quality, broader variety, time, and customization of a product are related to the decision-maker. Management of uncertainties applicable with the help of sharing the information creates visibility among supply chain partners (Shi & Yu, 2020). Supply chain visibility therefore helps with equipping more accurate, precise, faithful, and rigorous real-time portrait of demand, quality, and price indications or information about supplier's inventory levels (Tan, 2021).

In recent years, the concept of supply chain visibility (SCV) has been gaining the attention of practitioners and researchers (Catalayud et al., 2019). Many sources draw on the definition of SCV by Barratt and Oke (2017) as "the extent to which actors within a supply chain have access to or share information which they consider as key or useful to their operations and which they consider will be of mutual benefit". An important part of full supply chain visibility is making sure the business data that is being tracked is available to all stakeholders in the chain, including the customer.

Events such as Covid-19 pandemic have revealed some vulnerabilities that companies face due to low visibility (Sharma et al., 2020). The visibility upstream toward suppliers and downstream toward customers has been limited. Beyond the visible range, companies have no choice but to accept what happens (Carter et al., 2019). Lower-tier suppliers are much less visible and may not even be known to the focal firms (Choi et al., 2021). Consequently, companies experience supply chain disruptions concerning material supply, deliveries, productivity, and revenue (Caridi et al., 2020; Yu & Goh, 2019; Swift et al., 2019). In addition to affecting business performance, low visibility causes restricted ability to achieve supply chain resilience (Bregman et al., 2019). Thus, the management of supply chain disruptions in a network of global suppliers, operations, and markets has increased attention to SCV in order to attain sustainable and competitive business performance (Suh and Lee, 2020). In fact, visibility has become one of the most highlighted concerns conveyed by health care companies (Sodhi & Tang, 2019).

Firms are increasingly held accountable for their suppliers' transgressions (Swift et al., 2019). Therefore, firms need to develop upstream visibility to exercise control over their supply chains (Somapa et al., 2020). Patterns and trends identified through the analysis of supply chain allow the company to make informed decisions about how to optimize operations (Calatayud et al., 2019). The insight gained from supply chain analytics enables the company to better understand the performance of each activity within the supply chain and identify processes that require improvement to create more value for business and customers (Swift et al., 2019).

Presently hospitals are looking for new sources of competitive advantage and cost cutting measures wherever possible. It is imperative to look into the supply chain management aspects and identify areas in which they can improve the quality of service for efficient patient care. Supply Chain Management in healthcare should ensure complete end to-end visibility of

information among suppliers, manufacturers, distributors and customers. This study therefore seeks to establish the influence of supply chain visibility on performance of level 4 private hospitals in Kenya.

Pakistan's Ministry of National Health Services, Regulation, and Coordination had limited insight into the performance of its supply chains, resulting in widely varied stock-availability reports and stock performance across geographies, commodities, service-delivery entities, and sub-functions (Clement, Tuma, & Walter, et al., 2020). Stock availability at service-delivery points (SDPs), for example, was as high as 95 percent and as low as 36 percent at aggregate provincial levels across the country. Such lack of visibility presents problems for donors and governments that have a different view of key performance metrics, such as current warehouse inventory of vaccines (Dicko, 2020).

Nigeria's health system previously consisted of nine distinct supply chains and about 20 data systems, making distribution and supply management difficult and preventing providers and governments from making informed decisions on when (and how much) to replenish health commodities (Lakovou et al., 2019). A shared end-to-end view of events at different points in the supply-chain system would allow donors and governments to make better-informed decisions about where to allocate resources (Pereira et al., 2020).

Over the last five years, the health sector in Kenya led by the MOH has formulated sectoral guidance on health information system, including the management information system for Health Products and Technologies (HPT) (Supply Chain Strategy 2020-2025). There is significant fragmentation in the information systems currently used to support the HPT supply chain system. Though Logistics Management Information System (LMIS) designs exist for some HPT, they are not integrated and do not function adequately. Besides the lack of interoperability and limited integration, data visibility is limited at all levels of the supply chain and incomplete reporting is experienced.

Private hospitals have been clearly distinguished from the public hospitals by their ability to admit and take care of the inpatients. A treating facility owned by a for-profit or a non for-profit organization and is privately funded through payment for medical or healthcare services by patients themselves, by insurers, or by foreign embassies is what is termed as a private hospital. The Private healthcare hospitals have grown by wide margin for the past years due to absence of quality health care systems in the public health sector and introduction of user fees in 1989 (Kimani et al., 2019).

Statement of the Problem

Healthcare system in Kenya is still a national challenge, five decades after independence. For instance, Kenya has very few doctors compared to developed countries. Kenya with a total population of 46 million citizens, currently has 0.2 physicians per 1000 population. Comparatively, Sweden with a population of only 8 6 million citizens, has a physician density of 3.93 physicians per 1000 population (CIA, 2019). Consequently, Kenya has high morbidity and mortality rates affecting the population of all ages, especially children under five years. The infant mortality rate is about 58.1 per 1,000 live births, maternal mortality rate is about 414 per 1,000 and the overall under five child mortality rate is about 121 per 1,000 live births, which are all double of the global average (ROK, 2020).

Accountability and transparency on the utilization of health resources is also a major issue in Kenya (Mohajan, 2019). Ministry of health is the second most corrupt ministry in Kenya and the health department in the county governments is the department most perceived to be prone to corruption (EACC, 2020). Lack of basic infrastructure, poor health care policies and prevalent misappropriation of public funds has compromised the quality of health care in public healthcare sectors (Kenyanya, 2021). The study postulates that improvements in hospital SCM through application of supply chain visibility may directly improve performance of hospitals

in Kenya. Since 45% of the hospital operating budget is allocated to supply chain, improvements and innovations in supply chain management may provide significant impact on cost and quality of heathcare (Chen, Preston, & Xia, 2019).

There has been limited academic interest in recent years in supply chain visibility. Aberdeen (2019) did a study on the effect of SCV on supply chain costs and service levels. The study found that SCV if implemented will have positive influence on operational performance of the firm. Gustarsson (2019) carried out on how SCV can be applied in a case of Pulp Company in Sweden. The study concluded that information sharing was well implemented at the firm leading to visibility. In Kenya little related research had been done and there is need to conduct a study to deepen understanding of the role of SCV. The study answered the following question; what is the effect of demand visibility on performance of level 4 private hospitals in Kenya?

Specific Objectives

This study was guided by the following specific objectives;

i. To find out the effect of demand visibility on performance of level 4 private hospitals in Kenya
ii. To establish the moderating effect of technology adoption on the relationship between demand visibility and performance of level 4 private hospitals in Kenya.

Theoretical review

Knowledge-Based Theory

It is the theory of the firm that focuses attention on the resources and organizational capabilities as the principal sources of sustainable competitive advantage and the foundation for strategy formulation (Sveiby, 2001). This theory is fundamental to this study because it strongly advocates for use of information in the form knowledge for the benefit of the firm. However, this information should be strategic in that it can be used to add value to the supply chain or reduce complexities in the supply chain. Information is beneficial to a logistic firm if is used to lower the operational costs or avert a possible risk in the form of stock outs or high safety stock. This theory asserts that if knowledge is well managed within a firm, the firm becomes more competitive. This research seeks to go a mile further and examine the benefits of sharing knowledge across inter-firm for the benefit of the entire chain. Supply chain visibility will look to build upon this theory to ensure its goals are achieved.

The business change from resource-based production to information-based production created a paradigm shift in the operations of the firm. Organizations now realize more than ever before that in order gain from their operations they need to be knowledge-based. However majority lack an understanding on how to become one and what concepts they need to embrace in order to become one. The real thrust behind the operations of an organization is found in the immaterial resources of the organization (Zack, 2019). Knowledge provides a competitive edge that does not wither with time (Nonaka, 2019). Organizations should be able to link knowledge-based organizations with the knowledge-based advantage (Mc Evily, 2020), then organizations can be transformed to adapt to the ever-changing environment caused by technological advancement. Therefore, the theory is of importance to this study because it guides in understanding how knowledge visibility on orders, demands, quality and inventory can affect firm performance.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical framework that seeks to explain and predict how users come to accept and use technology. Developed by Davis (1989), TAM specifically addresses the factors that influence individuals' decisions to adopt new technologies, particularly information systems (Ferrer-Dávalos, 2023). The model posits that

two primary factors—perceived ease of use and perceived usefulness—determine a user's intention to use a technology, which in turn affects actual usage behavior. Perceived ease of use refers to the degree to which a person believes that using a particular technology would be free from effort (Mukamanzi & Ndikubwimana, 2022). If users feel that a technology is easy to learn and operate, they are more likely to adopt it. This aspect emphasizes the importance of user-friendly design and intuitive interfaces in promoting technology acceptance. On the other hand, perceived usefulness reflects the extent to which a person believes that using a specific technology would enhance their job performance or provide benefits in a broader context (Kiprop & Mutuku, 2024). When users recognize the potential advantages of a technology, such as increased efficiency or improved outcomes, they are more likely to form a positive intention to use it. TAM has been widely applied across various fields, including education, healthcare, and business, making it a versatile tool for understanding technology adoption. Researchers often utilize the model to evaluate new systems, software, or applications, gathering insights into user attitudes and potential barriers to acceptance (Asser, Waiganjo & Njeru, 2023). This can inform the design and implementation of technologies to better meet user needs and enhance the likelihood of successful adoption. For instance, in educational settings, understanding students' perceptions of a learning management system can help institutions improve its features and usability (Mandala, Ayoyi & Kipketer, 2024). This theory was used to establish the moderating effect of technology adoption on the relationship between supply chain visibility and performance of level 4 private hospitals in Kenya.

Conceptual Framework

According to Yin (2019), a conceptual framework refers to a diagrammatical representation showing the relationship between dependent and independent variables. Figure 2.1 below shows the independent variable, demand visibility and moderating variable which is technology adoption and dependent variable which is performance of level 4 private hospitals in Kenya.

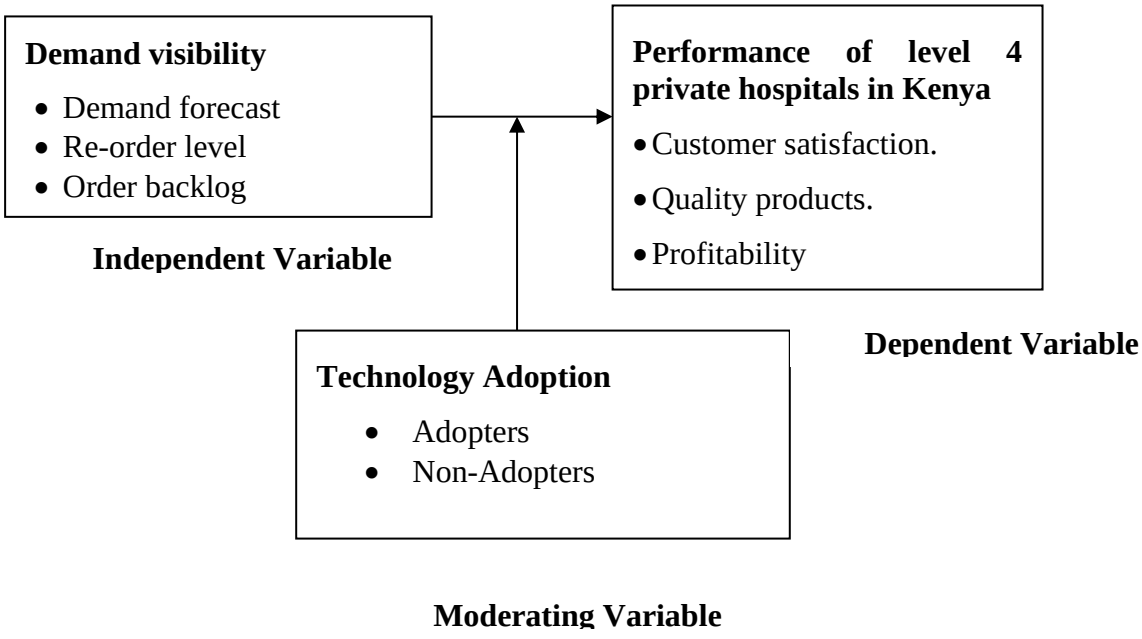

Figure 2. 1: Conceptual Framework

Source: Researcher (2022)

Demand Visibility

Lack of demand visibility has been identified as an important challenge for supply chain management (Chen, 2020). Commonly, the only factual demand information companies have access to are the orders placed by their customers (Cachon & Fisher, 2020). However, order information often gives a delayed and distorted picture of end customer demand and what actually happens in the market. It has been suggested that by sharing downstream demand information in the supply chain, many problems could be avoided and efficiency increased. Lee et al. (2019), for example, present making "demand data at a downstream site available to the upstream site" as an opportunity to mitigate what they call the bullwhip effect. Kiely (2019) also recommends that companies base their forecasts and production plans on POS data whenever possible

Demand variability is listed consistently as one of the top challenges affecting effective supply chain management at all maturity levels (Cachon & Fisher, 2020). Volatility, uncertainty, complexity and ambiguity are the four major causes of demand variability. With something like COVID-19, even the best-laid contingency plans may prove inadequate (Daugherty et al, 2021). Therefore, maintaining transparent, proactive relationships with your suppliers, activating alternate sources of supply, updating inventory policy and planning and aligning supply and demand management are some ways of improving company demand variability management plans in time of uncertainty (Fraza, 2020).

Technology adoption

Technology adoption refers to the process by which individuals, businesses, or institutions begin to use and integrate new technologies into their operations, routines, or lifestyles (Gustarsson, 2019). The process can vary depending on the complexity of the technology, the perceived benefits, cost, and the readiness of the users (Aberdeen, 2019). Technology adoption is not a one-size-fits-all experience—it is influenced by a myriad of factors including socio-economic conditions, organizational culture, user attitudes, and the availability of infrastructure. Within this framework, it is important to understand the dynamics of both adopters and non-adopters, as these two groups play crucial roles in shaping the pace and success of technological diffusion in a society or industry (Mandala, Ayoyi & Kipketer, 2024).

Adopters are individuals or entities that choose to embrace and implement new technologies (Asser, Waiganjo & Njeru, 2023). This group often sees the value and advantages associated with innovation, whether in terms of efficiency, cost-savings, competitive edge, or convenience. Adopters can be categorized into different groups based on Everett Rogers' Diffusion of Innovations theory—innovators, early adopters, early majority, late majority, and laggards (Kiprop & Mutuku, 2024). Innovators are risk-takers and the first to try out new technologies; early adopters follow, often influencing broader acceptance within a social system. The early and late majorities represent the bulk of adopters who join once a technology proves its value and becomes more accessible, while laggards adopt last, usually out of necessity rather than choice (Mukamanzi & Ndikubwimana, 2022). Non-adopters, on the other hand, are individuals or organizations that choose not to embrace new technologies. This decision can stem from various factors including financial constraints, lack of technical know-how, perceived irrelevance, fear of change, or cultural resistance (Ferrer-Dávalos, 2023).

Empirical Literature Review

Demand Visibility

Daugherty et al. (2019) examined the adoption and performance of automatic replenishment programs through a survey of US manufacturers and retailers. The results, although based on a small sample, indicated fairly widespread use, or plans for future use, of automatic replenishment programs in general, and VMI in particular. Furthermore, the study found a

positive relationship between automatic replenishment programs and company performance. Williams et al,. (2019) research on leveraging supply chain visibility for responsiveness: the moderating role of internal integration. Their study findings verify that internal integration can positively regulate the relationship between supply chain visibility (demand, supply, and market visibility) and supply chain responsiveness

Kaipia et al. (2019) used analytical modeling to develop a measure for the value of demand visibility and made similar observations regarding the different effects on different product types. The study demonstrated that implementing VMI can enable substantial inventory reductions as well as an opportunity to shift from make-to-stock to make-to-order production. Success stories from the industry demonstrate the potential of VMI in practice; companies have reported inventory reductions, improved customer service, and reduced obsolescence as the results of VMI adoption. VMI offers the vendor access to its customer's sales information, sometimes called sell-through information, rather than its orders. This means that one level of order batching is removed, allowing for more accurate, more rapidly available, and more level demand information. In addition, since the vendor is free to choose the timing of the shipments, it can further dampen demand peaks, for example, by delaying non-critical replenishments

Lapide (2019) suggests that the main reason why manufacturing companies have failed to benefit from VMI is that they have only implemented the execution part of VMI, i.e. the sales and distribution transactions. He claims that the companies have not managed to link the demand information, i.e. the customer sell-through information available through VMI to their production planning and inventory control systems. This corresponds with our own experience; most of the VMI implementations the authors have seen have lacked this link to supply chain planning. Consequently, one can conclude that linking demand information to supply chain planning seems to be of critical importance to benefiting from visibility efforts such as VMI

Technology Adoption

Ferrer-Dávalos (2023) conducted a study on the influence of technology adoption on organizational performance: evidence from Paraguayan microenterprises. Thirty-two microenterprise owners and managers were selected for this case study and participated in four phases of the action research method. The study found that the implementation has contributed to a significant improvement in administrative tasks and processes, making their overall work more efficient, more accurate and with greater speed. The study concluded that a correct implementation of information and communication technologies based on specific needs has a positive impact on the administrative performance of microenterprises.

Mukamanzi and Ndikubwimana (2022) assessed on the effects of technology adoption on Small and Medium sized enterprises in Rwanda: a case study of Kigali City. The study adopted a cross-sectional approach. Data was collected from 250 respondents with the help of a questionnaire. The study found that technology adoption has a strong, significant relation to Small and Medium sized enterprises. The study concluded that technology adoption influence Small and Medium sized enterprises in Rwanda.

Kiprop and Mutuku (2024) examined on the influence of technology adoption on the adoption of enterprise resource planning at The Kenya Medical Research Institute in Nairobi City County, Kenya. A descriptive survey design was utilized in the study. Semi-structured questionnaires will be administered for the data-gathering process. A census approach was used to select 52 employees of Kenya Medical Research Institute. The study found a positive influence of technology adoption on the adoption of enterprise resource planning. The study concluded that technology adoption is essential for supporting the scalability requirements of an enterprise resource planning system.

Asser, Waiganjo and Njeru (2023) researched on the influence of technology adoption interventions on performance of selected commercial state corporations in Kenya. The target

was 55 commercial state corporations and a total of 48 were studied. The study found a strong positive and significant relationship between technology adoption interventions and performance. The study concluded that technology adoption interventions influenced performance of commercial state corporations in Kenya.

RESEARCH METHODOLOGY

Research Design

The study adopted a cross-sectional research design. Cross sectional surveys are versatile in nature and therefore give accurate means of evaluating information while enabling the researcher to confirm whether there are significant causalities among the variables (Harlow, 2019). Research philosophy is the foundation of knowledge and the nature of that knowledge contains important assumptions about the way in which researchers view the world (Saunders, Lewis, & Thornhill, 2017). Research methods are influenced by philosophical orientations such as epistemology, which attempts to answer the basic question of what distinguishes true (adequate) knowledge from false (inadequate) knowledge. Epistemology is concerned with determining the nature of knowledge and the extent of human knowledge (Burrell & Morgan, 1979).

Target Population

According to National Hospital Insurance Fund (2022) there are 368 level 4 private hospitals in Kenya. The unit of analysis was therefore the 368 private hospitals in Kenya while the unit of observation was heads of procurement, quality assurance, finance, risk and compliance and audit. Therefore, the target population was 1,840 heads of departments in level 4 private hospitals in Kenya. The distribution of target population is presented in Table 3.1.

Table 3. 1: Target Population

Head of Department	Population
Procurement	368
Quality assurance	368
Finance	368
Risk and compliance	368
Audit	368
Total	**1,840**

The sample frame for this study was compiled from list of heads of procurement, quality assurance, finance, risk and compliance and audit. Therefore, the sampling frame was 1840 level 4 heads of departments in private hospitals in Kenya.

The overall sample size for this study was determined using a formula by Krejcie and Morgan (1970). The sample size for this study was determined as follows;

$$\text{Required sample size } \mathbf{(s)} = \frac{X^2NP\,(1-P)}{d^2\,(N-1) + X^2P\,(1-P)}$$

X^2=the table value of chi-square for 1 degree of freedom at the desired confidence level 1.96 x 1.96 = 3.8416. (for 0.05 confidence level)

N = the population size.

P = the Population proportion (assumed to be 0.50 since this would provide maximum sample size).

d = the degree of accuracy expressed as a proportion (0.05).

$$= \frac{3.8416 * 1840 * 0.5 * 0.5}{0.05^2(1840) + 3.8416 * 0.5 * 0.5} = \frac{1767.136}{5.5604}$$

= 319.807

≈ 320

Therefore, using the Krejcie and Morgan formula, the sample size for the study was 320 respondents.

This study will employ stratified random sampling. Babbie (2019) posit that stratified random sampling is appropriate when the population is not homogeneous. Stratified sampling is regarded as the most efficient system of sampling as there is little possibility of any essential group of population being completely excluded (Gupta & Gupta, 2019).

The study then used simple random sampling in selecting a sample from each strata. The sample size for each department was as shown in Table 3.2

Table 3. 2: Sample size

Head of Department	**Population**	
Procurement	368	64
Quality assurance	368	64
Finance	368	64
Risk and compliance	368	64
Audit	368	64
Total	**1,840**	**320**

Data Collection Instruments

In this study, primary data was used and was collected using a semi structured questionnaire because they are cost effective and convenient to collect and summarise responses (Kothari, 2019).

This study used both closed-ended questions and open ended questions to collect the data. Closed-ended questions were used where respondents were restricted to direct their answers without further explanation while the open-ended questions sought respondent's views on variables being studied.

The questionnaire includes Likert scale psychometric constructs with a scale ranging from 1-5 where each respondent will be required to rate each and every statement given describing a given variable. The scale ranges from 5=Strongly Agree, 4=Agree, 3=No Opinion, 2= Disagree and 1=Strongly Disagree.

Data Analysis and Presentation

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 28 software. The study performed descriptive analysis. Descriptive statistics enable the researcher to meaningfully describe a distribution of measurements and summarize data (Kothari, 2019; Mugenda & Mugenda, 2021).

Qualitative data collected (through the open ended section of the questionnaire) was coded, and repeated themes (responses) or concepts recorded until saturation is achieved (Jennings, 2019). Quantitative data was analysed using descriptive statistics including frequency, percentages and means, summary graphs, pie charts and frequency distribution tables were employed to portray the sets of categories formed from the data.

Pearson correlation coefficient was used for testing associations between the independent and the dependent variables.

This study also conducted inferential statistics through bivariate regression analysis and multiple regression analysis. Using SPSS software, the data was subjected to regression analysis. Simple linear regression analyses for (H_{01}, H_{02}, H_{03}, and H_{04}) and multiple regression analysis was used to establish the nature and the magnitude of the relationship between the dependent and the independent variables and to test the hypothesized relationships.

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

This study used multiple regressions analysis (stepwise method) to establish the moderating effect of technology adoption (M) on relationship between demand visibility and performance of level 4 private hospitals in Kenya. The moderating regression model was formed on a three steps approach

$$Y = \beta_{30} + \beta_{31} X + \beta 32 Me + \varepsilon_3$$

Regress the dependent variable (Performance of level 4 private hospitals in Kenya) on both the mediator (technology adoption) and independent variable (demand visibility).

RESEARCH FINDINGS AND DISCUSSIONS

Descriptive Analysis

The purpose of descriptive analysis is to give background to the study before carrying out analysis. In this section the study presents findings on Likert scale questions where respondents were asked to indicate their level of agreement with various statements to the establish the effect of demand visibility integration on performance of level 4 private hospitals in Kenya and the moderating effect of technology adoption. They used a 5-point Likert scale where 1-strongly disagree, 2-disagree, 3-moderate, 4-agree, 5-strongly agree. The means and standard deviations were used to interpret the findings where a mean value of 1-1.4 was strongly disagree, 1.5-2.4 disagree, 2.5-3.4 neutral, 3.5-4.4 agree and 4.5-5 strongly agree. Frequencies and percentages were also used to describe the findings obtained.

Demand Visibility and Performance of level 4 Private Hospitals

The first specific objective of the study was to find out the effect of demand visibility on performance of level 4 private hospitals in Kenya. The respondents were requested to indicate their level of agreement on various statements relating to demand visibility and performance of level 4 private hospitals in Kenya. A 5 point Likert scale was used where 1 symbolized strongly disagree, 2 symbolized disagree, 3 symbolized neutral, 4 symbolized agree and 5 symbolized strongly agree. The results were as presented in Table 1.

From the results, the respondents agreed that orders placed by customers are the only factual demand information they have access to. This is supported by a mean of 3.988 (std. dv = 0.864). In addition, as shown by a mean of 3.979 (std. dv = 0.858), the respondents agreed that order information often gives a distorted picture of end customer demand. Further, the respondents agreed that distortion of information tends to increase upstream in the supply chain. This is shown by a mean of 3.955 (std. dv = 0.902). With a mean of 3.888 (std. dv = 0.910), the respondents agreed that information distortion makes demand look variable and unpredictable.

The respondents agreed that basing production and inventories on distorted information leads to high stock levels. This is supported by a mean of 3.856 (std. dv = 0.873). In addition, as shown by a mean of 3.845 (std. dv = 0.889), the respondents agreed that downstream demand information sharing increases efficiency. Further, the respondents agreed that poor product availability results from demand information distortion. This is shown by a mean of 3.832 (std. dv = 0.873). With a mean of 3.798 (std. dv = 0.732), the respondents agreed that to improve efficiency, they always base demand forecasts and production plans on point-of-sale data. Further, the respondents agreed that Volatility, uncertainty, complexity and ambiguity results in demand variability. This is shown by a mean of 3.782 (std. dv = 0.789).

Table 1: Demand Visibility and Performance of level 4 Private Hospitals

	Mean	Std. Deviation
Orders placed by customers are the only factual demand information we have access to	3.988	0.864
Order information often gives a distorted picture of end customer demand	3.979	0.858
Distortion of information tends to increase upstream in the supply chain	3.955	0.902
Information distortion makes demand look variable and unpredictable	3.888	0.910
Basing production and inventories on distorted information leads to high stock levels	3.856	0.873
Downstream demand information sharing increases efficiency	3.845	0.889
Poor product availability results from demand information distortion	3.832	0.873
To improve efficiency, we always base demand forecasts and production plans on point-of-sale data	3.798	0.732
Volatility, uncertainty, complexity and ambiguity results in demand variability	3.782	0.789
Aggregate	**3.762**	**0.841**

The respondents were also requested to indicate how demand visibility affected performance of level 4 private hospitals in Kenya. From the results, the respondents indicated that demand visibility has had a transformative effect on the performance of Level 4 private hospitals in Kenya by enabling better resource planning and allocation. With a clearer understanding of patient demand trends, hospitals can anticipate the need for medical supplies, equipment, and personnel, ensuring they are adequately prepared to meet patient needs. Respondents pointed out that demand visibility has reduced instances of service delays and overcrowding, particularly in outpatient and emergency departments, by facilitating more accurate scheduling of resources. This has contributed to improved efficiency in service delivery, ultimately enhancing patient satisfaction and trust in the healthcare system.

Additionally, respondents emphasized that demand visibility has allowed hospital management to make data-driven decisions that optimize operational costs. For instance, by forecasting demand for specific services or procedures, hospitals can minimize wastage of perishable medical supplies and reduce unnecessary expenditures. Respondents also noted that improved demand visibility has strengthened collaboration with suppliers, ensuring timely restocking of essential items and avoiding disruptions in patient care. Moreover, respondents agreed that demand visibility has been instrumental in identifying patterns of patient behavior, such as peak service times, enabling hospitals to deploy staff and resources more effectively.

Technology Adoption and Performance of level 4 Private Hospitals

The second specific objective of the study was to establish the moderating effect of technology adoption on the relationship between demand visibility and performance of level 4 private hospitals in Kenya. The respondents were requested to indicate their level of agreement on statements relating to technology adoption and performance of level 4 private hospitals. A 5 point Likert scale was used where 1 symbolized strongly disagree, 2 symbolized disagree, 3 symbolized neutral, 4 symbolized agree and 5 symbolized strongly agree. The results were as presented in Table 2.

From the results, the respondents agreed that their organization implements automated systems to handle repetitive and manual tasks. This is supported by a mean of 3.968 (std. dv = 0.905). In addition, as shown by a mean of 3.959 (std. dv = 0.885), the respondents agreed that the use of process automation improves the overall efficiency of their business operations. Further, the

respondents agreed that employees are trained and comfortable using automated systems to perform their tasks. This is shown by a mean of 3.920 (std. dv = 0.605).

With a mean of 3.855 (std. dv = 0.981), the respondents agreed that their current IT infrastructure is scalable and supports the growth of their business. Further, with a mean of 3.841 (std. dv = 0.873), the respondents agreed that they regularly invest in upgrading their infrastructure to ensure high system reliability and performance. The respondents also agreed that their infrastructure includes advanced security measures to protect against cyber threats. This is shown by a mean of 3.838 (std. dv = 0.786).

From the results, the respondents agreed that their organization employs skilled IT professionals who are well-versed in the latest technologies. This is supported by a mean of 3.812 (std. dv = 0.786). In addition, as shown by a mean of 3.796 (std. dv = 0.897), the respondents agreed that IT experts in their organization actively contribute to improving their technological capabilities. Further, the respondents agreed that IT experts are involved in decision-making processes for the adoption of new technologies in the organization. This is shown by a mean of 3.768 (std. dv = 0.934).

Table 2: Technology Adoption and Performance of level 4 Private Hospitals

	Mean	**Std. Deviation**
Our organization implements automated systems to handle repetitive and manual tasks.	3.968	0.905
The use of process automation improves the overall efficiency of our business operations.	3.959	0.885
Employees are trained and comfortable using automated systems to perform their tasks.	3.920	0.605
Our current IT infrastructure is scalable and supports the growth of our business.	3.855	0.981
We regularly invest in upgrading our infrastructure to ensure high system reliability and performance.	3.841	0.873
Our infrastructure includes advanced security measures to protect against cyber threats.	3.838	0.786
Our organization employs skilled IT professionals who are well-versed in the latest technologies.	3.812	0.786
IT experts in our organization actively contribute to improving our technological capabilities.	3.796	0.897
IT experts are involved in decision-making processes for the adoption of new technologies in the organization	3.768	0.934
Aggregate	**3.815**	**0.867**

The respondents were further requested to indicate how technology adoption affected performance of level 4 private hospitals in Kenya. From the results, the respondents highlighted that the integration of electronic health records (EHR) and hospital management systems has streamlined administrative tasks, reduced paperwork, and improved communication between departments. Additionally, the implementation of telemedicine services has increased access to healthcare, particularly for patients in remote areas, while also reducing the burden on physical infrastructure. These advancements have led to quicker diagnoses, more accurate treatment plans, and enhanced patient satisfaction, as medical staff are able to make more informed decisions with real-time data.

However, some respondents pointed out challenges related to technology adoption, particularly in terms of costs and training. The initial investment in hardware, software, and training staff to efficiently use these technologies can be prohibitive for some hospitals. Additionally, there

are concerns about the reliability of some systems and the need for regular updates and maintenance. Despite these challenges, most respondents agreed that the benefits of technology adoption far outweigh the drawbacks, and there is a growing recognition of the need for ongoing investment in healthcare technology to maintain high standards of service delivery and ensure long-term sustainability.

Test for Hypothesis One

The first specific objective of the study was to find out the effect of demand visibility on performance of level 4 private hospitals in Kenya. The associated null hypothesis was that demand visibility has no statistically significant influence on performance of level 4 private hospitals in Kenya. A univariate analysis was conducted in which performance of level 4 private hospitals in Kenya was regressed on demand visibility.

The R-Squared depicted the variation in the dependent variable that can be explained by the independent variables. The greater the value of R-squared the greater the effect of independent variable. The R Squared can range from 0.000 to 1.000, with 1.000 showing a perfect fit that indicates that each point is on the line. As indicated in Table 4.3, the R-squared for the relationship between demand visibility and performance of level 4 private hospitals in Kenya was 0.241; this is an indication that at 95% confidence interval, 24.1% of variation in performance of level 4 private hospitals in Kenya can be attributed to changes in demand visibility. Therefore, demand visibility can be used to explain 24.1% of changes in performance of level 4 private hospitals in Kenya but there are other factors that can be attributed to 75.9% change in performance of level 4 private hospitals in Kenya.

Table 3: Model Summary for Demand Visibility

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.491[a]	.241	.240	.67231

a. Predictors: (Constant), Demand Visibility

The analysis of variance was used to determine whether the regression model is a good fit for the data. It also gave the F-test statistic; the linear regression's F-test has the null hypothesis that there is no linear relationship between the two variables. From the analysis of variance (ANOVA) findings in Table 4, the study found out that that Prob>$F_{1, 249}$= 0.000 was less than the selected 0.05 level of significance. This suggests that the model as constituted was fit to predict performance of level 4 private hospitals in Kenya. Further, the F-calculated, from the table (461.31) was greater than the F-critical, from f-distribution tables (3.879) supporting the findings that demand visibility can be used to predict performance of level 4 private hospitals in Kenya.

Table 4: ANOVA for Stakeholders

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.67	1	45.67	461.31	.000[b]
	Residual	24.725	249	0.099		
	Total	70.395	250			

a. Dependent Variable: Performance of level 4 private hospitals in Kenya
b. Predictors: (Constant), demand visibility

From the results in Table 5, the following regression model was fitted.

$$Y = 0.236 + 0.376 X_1$$

(X_1 is Demand visibility)

The coefficient results showed that the constant had a coefficient of 0.236 suggesting that if demand visibility was held constant at zero, performance of level 4 private hospitals in Kenya would be 0.236 units. In addition, results showed that demand visibility coefficient was 0.376 indicating that a unit increase in demand visibility would result in a 0.376 improvement in performance of level 4 private hospitals in Kenya. It was also noted that the P-value for stakeholders coefficient was 0.000 which is less than the set 0.05 significance level indicating that demand visibility was significant. Based on these results, the study rejected the null hypothesis and accepted the alternative that demand visibility has positive significant influence on performance of level 4 private hospitals in Kenya.

Table 5: Beta Coefficients for Demand Visibility

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.236	.074		3.189	.000
	demand visibility	0.376	0.099	0.377	3.798	0.000

a. Dependent Variable: Performance of level 4 private hospitals in Kenya

Test for Hypothesis Two

The second objective of the study was to establish the moderating effect of technology adoption on the relationship between demand visibility and performance of private hospitals in Kenya. Moderation happens when the relationship between the dependent variable and the independent variables is dependent on a third variable (moderating variable). The effect that this variable has is termed as interaction as it affects the direction or strength of the relationship between the dependent and independent variable. To achieve the first research objective, the study computed moderating effect regression analysis. This (moderating effect regression analysis) also guided the study in testing the first research hypothesis. Technology adoption (M) was introduced as the moderating variable.

Ho_5: Technology adoption has no moderating effect on the relationship between demand visibility and performance of private hospitals in Kenya.

The study combined demand visibility to form a new variable X. The study then used stepwise regression to establish the moderating effect of technology adoption (M) on the relationship between independent variable (X) and performance of private hospitals in Kenya (Y).

From the model summary findings in Table 4.6, the first model for which is the regression between demand visibility (X) without moderator, technology adoption (M) and interaction, the value of R-squared was 0.336 which suggests that 33.6% change in performance of private hospitals in Kenya can be explained by changes in demand visibility. The p-value for the first model (0.000) was less than the selected level of significance (0.05) suggesting that the model was significant. The findings in the second model which constituted demand visibility, technology adoption and performance of private hospitals in Kenya (X*M) as predictors, the r-squared was 0.568. This implies that the introduction of technology adoption in the second model led to a 0.232 increase in r-squared, showing that technology adoption positively moderates performance of private hospitals in Kenya.

Table 6: Model Summary for Moderation Effect

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.580[a]	.336	.334	.65170	.336	150.295	1	249	.000
2	.754[b]	.568	.564	.52727	.232	79.360	3	247	.000

a. Predictors: (Constant), demand visibility

b. Predictors: (Constant), demand visibility, technology adoption, Interaction (X*M)

From the model summary findings in Table 7, the F-calculated for the first model, was 733.70 and for the second model was 654.29. Since the F-calculated for the two models were more than the F-critical, 3.879 (first model) and 2.641 (second model), the two models were good fit for the data and hence they could be used in predicting the moderating effect of technology adoption on the performance of private hospitals in Kenya.

Table 7: ANOVA for Moderation Effect

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63.832	1	63.832	733.70	.000[b]
	Residual	21.675	249	0.087		
	Total	85.507	250			
2	Regression	107.958	3	35.986	654.29	.000[c]
	Residual	13.622	247	0.055		
	Total	121.58	250			

a. Dependent Variable: performance of private hospitals in Kenya
b. Predictors: (Constant), demand visibility
c. Predictors: (Constant), demand visibility, technology adoption, Interaction

Further, by substituting the beta values as well as the constant term from the coefficient's findings for the first step regression modelling, the following regression model will be fitted:

$Y = 1.387 + 0.608 X$

Where X is demand visibility

The findings show that when demand visibility is held to a constant zero, performance of private hospitals in Kenya will be at a constant value of 1.387. The findings also show that demand visibility has a statistically significant effect on performance of private hospitals in Kenya as shown by a regression coefficient of 0.608 (p-value= .000).

By substituting the beta values as well as the constant term from model 2 emanating from the second step in regression modelling the following regression model was fitted:

$Y= 3.876 + 0.220 X + 0.325 M + 0.283 X*M$

Where X is demand visibility; M is technology adoption and X*M is the interaction term between demand visibility and technology adoption.

The findings show that when demand visibility, technology adoption, interaction (X*M) are held to a constant zero, performance of private hospitals in Kenya will be at a constant value of 3.876. The model also indicated that demand visibility had a positive and statistically significant effect on performance of private hospitals in Kenya as shown by a regression coefficient of 0.220 (p-value= 0.002). It is also seen that technology adoption had a positive and significant effect on performance of private hospitals in Kenya as shown by a regression coefficient 0.325. On the other hand, interaction of demand visibility and technology adoption (X*M) also had a positive and significant effect on performance of private hospitals in Kenya as shown by a regression coefficient of 0.283 (p-value= 0.000).

It is therefore seen that determinants of demand visibility on its own has 22% effect on performance of private hospitals in Kenya. However, when interacted with technology adoption, it has an effect of 28.3%. This is a clear indication that introduction of technology adoption as moderating variable has positive influence on performance of private hospitals in Kenya. The study therefore rejects the null hypothesis and accepts the alternative that technology adoption has significant moderating effect on the relationship between demand visibility and performance of private hospitals in Kenya.

Table 8: Beta Coefficients for Moderation Effect

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.387	.194		7.163	.000
	demand visibility	.608	.050	.580	12.260	.000
2	(Constant)	3.876	1.009		3.841	.000
	demand visibility	.220	.067	.782	3.284	.002
	technology adoption	.325	.048	.310	6.748	.000
	Interaction (X*M)	.283	.065	1.661	4.357	.000

a. Dependent Variable: Performance of private hospitals in Kenya.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Demand Visibility and Performance of Private Hospitals

The second null hypothesis test was 'demand visibility has no significant effect on performance of private hospitals in Kenya. The study found that demand visibility is statistically significant in explaining performance of private hospitals in Kenya. The influence was found to be positive. This means that unit improvement in demand visibility would lead to an increase in performance of private hospitals in Kenya'. Based on the findings, the study concluded that demand visibility positively and significantly influences with performance of private hospitals in Kenya.

Technology Adoption and Performance of Private Hospitals

The fifth research hypothesis tested was that 'Technology adoption has no significant moderating effect on the relationship between demand visibility and performance of private hospitals in Kenya. The study revealed that technology adoption is statistically significant in explaining performance of private hospitals in Kenya. It was also found that the interaction between technology adoption and demand visibility had positive, statistically significant effect on performance of private hospitals in Kenya. Based on the findings, the study concludes that technology adoption has significant moderating effect on the relationship between demand visibility and performance of private hospitals in Kenya.

Recommendations

Demand Visibility

The study recommends private hospitals to implement advanced demand forecasting and inventory management systems to improve demand visibility and optimize their inventory management processes. These systems can help hospitals anticipate patient needs more accurately, reduce waste, and enhance overall performance. The hospitals should invest in demand forecasting software that utilizes historical data, patient demographics, and other relevant factors to predict patient admissions, treatment needs, and demand for medical supplies.

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