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Technological Factors and Competitive Advantage in Retail Pharmacies in Nairobi County, Kenya

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Abstract

The purpose of this research was to determine the influence of technological factors on competitive advantage in retail pharmacies in Nairobi. The study was grounded on the Technology, Organization, and Environment (TOE) framework and adopted post-positivism as the research philosophy. A quantitative approach was used, and primary data were collected through a structured, digitally administered questionnaire. The study targeted 365 registered retail pharmacies that had more than one branch. Stratified random sampling was used to select a sample of 170 pharmacies, and a total of 162 valid responses were received, resulting in a 95% response rate. Data analysis was conducted using Spearman's rank correlation, chi-square tests, and ordinal logistic regression. A weak positive correlation was observed between the variables ($\rho = 0.156$), and the association was statistically significant ($X^2 = 6.759$, $df = 1$, $p = 0.03$). The study concluded that while technological factors did not show strong statistically significant influence on competitive advantage, organizational culture observed qualitatively played a decisive role as a moderator. The study recommends future research on other actors in the pharmaceutical value chain, including distributors and manufacturers, to expand understanding of e-commerce impact. It also recommends further investigation into cultural dimensions using alternative approaches. The findings are expected to support evidence-based decision making for pharmacy owners, digital transformation policymakers, and stakeholders.

Key Words: ***Competitive Advantage, E-commerce adoption, Retail Pharmacies, technological Factors, TOE Framework***

Background of the Study

In today's global economy, organizations strive to establish robust competitive positions (Mugo & Macharia, 2020). However, competition in the modern world is exceedingly dynamic and complex. This complexity leads to rapid impacts or even the erosion of companies' competitive advantages due to new technologies, products, shifts in market

boundaries, advancements in manufacturing processes, and innovative management concepts (Kazemi, A., Kazemi, Z., Heshmat, H., Nazarian-Jashnabadi, J., & Tomášková, H., 2024). The

concept of competitive advantage was first developed by Porter (1985) where he argued that how a firm is positioned within the relevant industry determines whether its profitability is above or below the industry average. This concept of competitive advantage has gained growing importance in the digital economy, where the so considered traditional sources of advantage such as economies of scale and tangible assets, are being disrupted. In the digital age, competitive advantage is progressively rooted in intangible assets such as data, patented technology, digital infrastructure and a firm's ability to innovate and adapt quickly (Urbanek, 2022).

The fast pace of technological change implies that sustainable competitive advantage is now much more difficult to sustain, making agility, digital capabilities, and continuous strategic innovation crucial for organizations to survive and thrive (Candraningrat, C., Handriana, T., & Saifuddin, M., 2025). Kenya plays a key role in the Sub-Saharan Africa's pharmaceutical landscape, with a market share valued at $3 billion and significant growth potential driven by the growing population and enhanced internet penetration (Ministry of Industrialization, Trade and Enterprise Development, 2020). Growth within the pharmaceutical sector is additionally supported by a conducive business environment that is increasingly becoming more mature with policies that favor local manufacturing (IFC, 2020).

According to Chevalier and Gutsatz (2020), mobile technology and its penetration has been a major driver, enabling advancements in telemedicine, supply chain management, and overall financing within the pharmaceutical sector which are critical for scaling digital adoption across the country. Despite the potential demonstrated within the pharmaceutical sector, e-commerce adoption faces significant hurdles, often linked to cost, complexity, firm size, and government support (Kimana, 2020). High costs associated with technological investment and operationalization coupled with scarce financial resources, remains a key barrier, particularly for the retail pharmacies (Kiveu et al., 2019; IFC, 2020).

According to Wali et al., (2023) barriers to adoption has been intensified by the complexity of integrating new digital systems, which has been a major influence behind the industry's poor technology adoption rates. Additionally, the noticeable absence of supportive government policies such as weak policy support and unclear regulations, adds to these challenges and hinders the needed investments in digital infrastructure (Lukonga, 2020). The rising pressure to remain competitive and relevant has intensified the need for the retail pharmaceutical sector to embrace e-commerce, bringing out a clear strategic opportunity (Kimana, 2020).

E-commerce adoption provides noteworthy relative advantage that allows these retail firms to increase their market share and enhance their operational efficiency (Arasa & Irungu, 2017). This strategic move is particularly important for retail pharmacies, where adopting innovative technologies is a key driver to building a strong competitive advantage (Kiveu et al., 2019). The achievement of these initiatives, however, heavily relies on strong top leadership support as well as organizational readiness to compete effectively (Wali et al., 2023; Ocloo et al., 2020). By leveraging these factors, the retail pharmaceutical sector can transform its

operational efficiency and secure its competitive position in the evolving digital economy. While existing research acknowledges that technological factors influence competitive

advantage (Khoo, Ahmi & Saad, 2018), significant research gaps still exist in the literature. There are limited studies that have been able to successfully establish a direct link between technological factors and competitive advantage within the retail pharmaceutical sector in Kenya. This study aims to build upon existing literature by investigating whether technological factors influence competitive advantage within the retail pharmacies in Nairobi and aims to fill the identified gaps by examining this relationship.

Statement of the Problem

The retail pharmaceutical industry is undergoing rapid global transformation, with e-commerce emerging as a powerful tool to enhance business efficiency, expand market share, and boost revenue growth translating to competitive advantage (Porter, 1985; Bowman & Asch, 1996). Globally, the value of the retail pharmaceutical market is projected to reach USD 234 billion by 2026 (Mordor Intelligence, 2025), with businesses in North America and Europe seeing profit increases of up to 50% through digital adoption (Pasquali, 2023; Fedewa et al., 2023). However, in Africa, despite the potential for digital tools to significantly increase healthcare access, this growth is hampered by a low overall internet usage rate of just 43% (Gelder, 2025). As Kenya's key economic centre, Nairobi reflects these global trends but also faces unique local challenges (Ntwiga et al., 2021). Therefore, this study seeks to address the existing gap of how retail pharmacies in Nairobi can navigate these specific hurdles and leverage digital tools to secure a sustainable competitive advantage. According to Awa et al. (2015), a better understanding of technological adoption within a firm is typically anchored on the Technology-Organization-Environment (TOE) framework (Tornatzky et al., 1990) which intricately studies the organizational characteristics to determine innovation adoption. According to Kim et al., (2023), technological factors, such as the perceived benefits, ease of use, and costs of new systems are essential for adoption. While the TOE framework provides a solid foundation for the mentioned studies, a significant gap still exists in exploring the relationship between technological factors and competitive advantage within the retail pharmaceutical sector in Nairobi. Given this research scarcity, there is a pressing need to investigate how technological factors influence competitive advantage within Nairobi's retail pharmacies. The results of this study will provide crucial insights for industry stakeholders and regulators, supporting the advancement of a sustainable and digitized healthcare system in Kenya.

Hypothesis of the Study

H_{01}: Technological factors positively influence competitive advantage in retail pharmacies in Nairobi.

Literature Review

Theoretical Review

Technology, Organization and Environment Framework (TOE)

The Technology, Organization, and Environment (TOE) framework was developed to clarify the major organizational choices that guide how innovations are adopted (Tornatzky et al., 1990). According to Tornatzky et al., (1990), technological advances should be evaluated within the context of an organization because implementing them typically demands appropriate resource allocation and mobilization. Additionally, factors in the external environment such as government regulations, competitive pressure, and industry standards significantly affect how innovations are embraced. The framework defines technology as a means to boost productivity within firms and considers innovation to be the process of incorporating new technologies into operations (Tornatzky et al., 1990). However, once such technology becomes part of everyday practice, it is no longer seen as an innovation. The TOE

model outlines three main areas that shape adoption: the technological factors, the organizational factors, and the external task environmental factors (Tornatzky & Fleischer, 1990).

Technological Factors

The technological factors within the TOE framework examines both the technologies currently in use within an organization and the emerging innovations available in the market (Tornatzky et al., 1990). According to Tornatzky et al., (1990), existing technologies are important because they influence how quickly, and effectively new technologies can be adopted. The adoption process of an innovation is influenced by factors such as cost, complexity, relative advantage, compatibility and observability and innovations can generally be classified into three categories: continuous, which involve gradual improvements to existing technologies; synthetic, which combine elements of both existing and new technologies; and discontinuous, which represent radical shifts that can significantly disrupt current systems such as the emergence of ride-sharing platforms like Uber (Tornatzky et al., 1990).

While continuous and synthetic innovations can typically be integrated in a structured and manageable way, discontinuous innovations often require significant adjustments and may render existing resources or systems obsolete (Tornatzky et al., 1990). As such, it is crucial for organizations to carefully assess the type and scale of changes involved in adopting new technologies, as this will affect planning, resource allocation, and long-term strategic alignment. Despite its widespread use, the TOE framework has faced several criticisms. Zhu and Kraemer (2005) argue that the model is overly generic and allows for too much flexibility in its application, making it difficult to draw clear theoretical conclusions.

Zhu and Kraemer (2005) suggest that while the framework is useful for classifying factors that influence technology adoption, it lacks the theoretical depth needed to fully explain the underlying mechanisms of innovation adoption within organizations. According to Baker (2011) the model does not clearly account for the interaction between the variables resulting to oversimplification when it comes to decision making within the business context. On the other hand, Oliveira and Rosario (2011) stated that the model focuses on organizations and does not bring out individual factors such as innovativeness which influence adoption decisions.

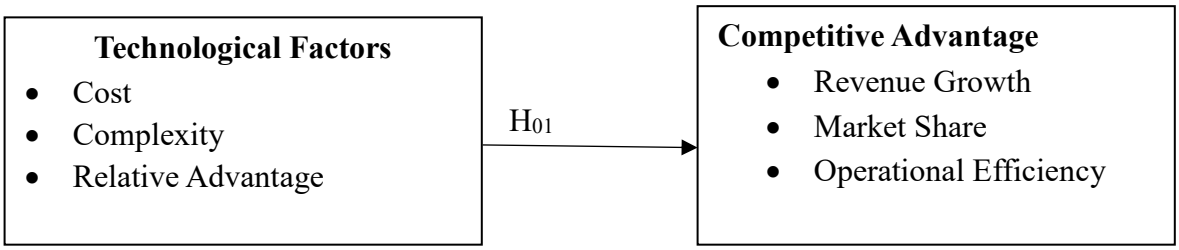
Competitive Advantage

Competitive advantage can be viewed as the firm's position within a competitive market. All firms aim to create and sustain a competitive advantage and are consistently looking into the external environments for opportunities and threats while examining internally for strengths and weaknesses. Porter (1985) defined competitive advantage as the unique position that a company or organization establishes in its industry or market, which allows it to outperform its competitors and generate superior financial returns over the long term.

Porter (1985) argues that competitive advantage is the result of a company effectively utilizing its available resources, capabilities, and core competencies in a way that creates value for customers and differentiates the company from its rivals. According to Bowman and Asch, (1996), the core of an organizational strategy is formed through a clear plan of sustainable competitive advantage since it determines the choices an organization needs to make in terms

of where to compete and how competitive advantage can be gained in these markets. Njoroge (2019) notes that internet and technology have advanced quickly in Kenya, leading many firms to adopt e-commerce as an effective way to conduct their operations. However, majority of the business especially within the retail sectors, are yet to understand how, through e-commerce adoption, they can gain and sustain competitive advantage.

Conceptual Framework



Independent Variable **Dependent Variable**

Empirical Review
Technological Factors

Technology is widely recognized as a key driver in the adoption of e-commerce among retailers. According to Hoang and Nguyen (2022), the perceived cost and compatibility of technology are critical factors in positioning e-commerce as a source of competitive advantage. Additionally, according to Hoang and Nguyen (2022), a robust digital infrastructure coupled with modern technology platforms, together with its capability for data analytics and personalization, enables retailers to create unified customer experience while engaging them online. While both studies highlight the importance of technology as a driver of e-commerce, notable gaps on how these factors come into play in a resource constrained environment remains unexamined.

Saura et al. (2022) found that technology has a direct impact on competitive advantage, highlighting that factors such as cost and compatibility affect how quickly and extensively it is adopted. However, the study noted that emphasis on perceived cost and seamless compatibility meant that firms had a higher likelihood of embracing technologies that were reasonably priced and easily integrated into their existing operations. In the Kenyan context, Odhiambo and Mang'ana (2022) explored how the strategic adoption of technological innovations influences competitive advantage within commercial banks. Targeting 43 commercial banks, the study gathered data from branch managers, heads of customer service, IT leaders, and relationship officers.

Out of 215 questionnaires distributed, 192 responses were received. The findings revealed that innovative technologies had a significant and positive impact on the competitive advantage of commercial banks. However, the study also highlighted the importance of recognizing the risks associated with technological innovation and the need for firms to safeguard consumer data.

Given the results focused on financial institutions, a contextual gap exists on whether similar results would be achieved in the retail pharmaceutical sector.

1. **Cost**

Technology has long been recognized as a critical factor in a firm's competitiveness, yet the high costs associated with its adoption often pose a significant challenge, especially for small businesses. Djerdjouri (2020) notes that many small retail pharmaceuticals suffer a loss of competitive advantage when they cannot afford to invest in the necessary digital technologies. Smaller firms with low capital and technological expertise often possess limited upfront investment in hardware, software, and skilled people, hence can create a substantial barrier to entry or expansion within digitally driven markets. This inability to adopt essential technologies has a direct impact on these smaller retail firms on their capacity to achieve operational efficiencies, gain market share through e-commerce, or innovate customer experiences (Djerdjouri, 2020).

An additional study by Hoosen (2023) focused on whether financial resources influence the adoption of artificial intelligence among South African MSMEs. Using online questionnaires, data were collected from 55 respondents. The study found that although cost was a factor considered before adopting AI technology, it was not the primary determinant. Firms prioritized long-term benefits such as continued revenue generation, competitiveness, and return on investment. The study demonstrated that the MSMEs that did not put cost as the only consideration had foresight and made decisions based on the anticipated long-term value when it comes to technological investment.

According to Hoosen (2023), the prioritization of sustained revenue generation by MSMEs and increasing their chances of attaining and sustaining competitive advantage enabled the firms to view the adoption of technology as an investment as compared to an expenditure. In the Kenyan context, Thomas et al. (2023) conducted a study on the adoption of biometric technology among banks in Uasin Gishu County. The study targeted 28 commercial banks, with a total of 272 respondents. The findings established a significant positive relationship between cost and the adoption of biometric technology. However, due to the growing demand for enhanced security, most banks have begun opting for more affordable suppliers.

The significant positive relationship between cost and biometric technology adoption suggests that banks are willing to invest more in these advanced security measures, recognizing their importance in safeguarding assets and maintaining customer trust. According to Thomas et al. (2023), the study revealed that higher-cost technological solutions, were perceived to be more robust, hence increasing their rate of adoption. However, there is need for additional research perceive the value of e-commerce adoption even as the digital landscape continues to evolve.

2. **Complexity**

Social media technology has enabled many retail firms to effectively use online platforms for advertising and selling their products and services, often at relatively low cost compared to traditional marketing channels. Mahakittikun et al. (2020) investigated the role of technology complexity in relation to competitive advantage among SMEs in Thailand, and their findings

revealed no significant relationship between complexity and firm performance. However, based on the findings of the study, the innate advantage of social media ideally lies in its ability to offer personalized advertising while deliberately engaging with customers and having an opportunity to build the company's brand compared to the traditional methods.

Similarly, a study by Ochola (2013) in Kenya, using a mixed methods design with 386 respondents, confirmed a significant negative relationship between complexity and competitive advantage among SMEs, reinforcing the notion that excessive complexity in technology systems acts as a barrier to achieving a competitive edge. The findings by Hamad et al. (2018), Ochola (2013) additionally emphasizes this by demonstrating that for SMEs, technological systems that are too complex bring about difficulty in implementation, costly to maintain, and challenging for staff to easily use. In the long run, such complexity prevents businesses from fully taking advantage of the technology to enhance market receptiveness, streamline operations, or innovate effectively, thus directly impeding their ability to achieve and sustain competitive competitiveness in the market. However, neither of the studies examines whether firms that are able to overcome technological complexities are able to gain and sustain competitive advantage.

3. Relative Advantage

A study by Mahakittikun et al. (2020) sought to establish whether there is a relationship between relative advantage, which is considered a factor of diffusion of innovation, and competitive advantage within SMEs in Thailand. The sample consisted of 387 participants from both retail and service firms, and questionnaire surveys were used for data collection. The results indicated a significant positive relationship between relative advantage and the firm's performance in gaining competitive advantage, adding that an increase in relative advantage resulted in an increase in competitive advantage.

According to Mahakittikun et al. (2020), the clarity of benefits derived from relative advantage is critical as their restricted resources require investments with clear and concrete returns. As a result, companies that closely identify and leverage such relative advantages are highly likely to entirely adopt and effectively employ these innovations, resulting into a demonstrable increase in their competitiveness. The study, however, does not clearly articulate practical steps required for successful adoption. Conversely, not all studies have found a uniform relationship.

Awiagah et al. (2016), in Ghana, using a sample of 105 SMEs, reported no significant positive relationship between relative advantage and competitive advantage. The findings from the study suggested that this might be due to the low level of e-commerce adoption and limited awareness of the benefits among these SMEs. Additionally, the findings from the study pointed out a critical challenge where SMEs may not yet wholly grasp or experience

the tangible benefits of e-commerce, therefore failing to articulate clearly perceived advantage into actual competitiveness within the firm. However, within the Kenyan context, Ochola (2013) utilized a mixed research design with 386 respondents to demonstrate a significant positive association between relative advantage and competitive advantage, highlighting that when firms in Kenya recognize the benefits, such as cost reduction, market expansion, and an increased customer base, they are more likely to successfully adopt e-commerce and enhance

their competitive positioning. Ochola (2013) extensive study in Kenya validates that when businesses clearly define and appreciate the practical benefits of digital solutions and innovations, they would experience a significant growth on their customer base through online channels, this realization directly drives successful e-commerce implementation and adoption.

Research Methodology

This study is grounded in a post-positivist philosophical perspective, which is closely aligned with quantitative methods and is commonly referred to as the scientific approach (Creswell & Creswell, 2017). Unlike interpretivism, which focuses on understanding human experiences in context using qualitative inquiry, or critical theory, which is majorly focused on bringing power structures and driving social change (Ryan, 2018), post-positivism is grounded in the idea of objective inquiry while recognizing that absolute truths are elusive. Researchers operating within this paradigm aim to identify causal relationships by reducing complex phenomena into measurable variables and testing hypotheses through structured methodologies (Creswell & Creswell, 2017). The study adopted a quantitative cross-sectional research approach because it allows for the collection of data at a particular point in time, making it efficient and most appropriate for recognizing patterns and associations within a specified population. The population comprised 365 retail pharmacies, with particular attention given to key leadership roles, including the owner or CEO, the head of ICT, and the head of operations or finance. This study employed probability sampling due to its suitability for generating statistically valid and generalizable results. The study further adopted stratified sampling, clustering the pharmacies further according to number of branches. A sample size of 190 was derived using a formula suggested by Yamane (1967);

n= N/ (1+N (e)2) where:

n= sample size

N= population under study (the population for the study was 365)

e= the margin of error

With 95% confidence level (or margin of error, e = 5% or 0.05)

- n=365/ (1+365(0.05)2)
  = 365/ (1+365(0.0025)
  = 365/2.225
  n=190

Table 1

Categorization of Retail Outlets by sector and sample distribution

Retail Pharmacies	Sample Size	Percentage

2-3 branches	95	50%
4-6 branches	88	46.32%
>7 branches	7	3.68%
	190	**100%**

Semi-structured questionnaires were utilized to collect primary data. Permission to conduct the study was obtained from the United States International University-Africa (USIU-A) Institutional Ethics Review Committee. Additional permission to conduct the study was requested from and approved by the National Commission for Science, Technology and Innovation (NACOSTI). The study employed both descriptive and inferential statistics. For this study, the reliability of the data collection instrument was assessed using Cronbach's alpha to ensure internal consistency among the items.

The computed Cronbach's alpha coefficient was 0.745, based on a sample of 18 respondents. Content validity was reached through a structured process of instrument development directed by the objectives of the study and a widespread review of relevant literature. The variables of the study did not demonstrate any multicollinearity with VIF values ranging from 1.01-1.46. The results of the tests indicated that non-response bias was not a concern in this study. Specifically, no significant differences were observed for Cost mean ($t = -0.535$, $p = 0.613$), Complexity mean ($t = 1.195$, $p = 0.262$), or Relative Advantage mean ($t = -0.767$, $p = 0.461$). These findings suggest that the responses obtained are representative, and non-respondents did not systematically differ from respondents. Additionally, the results demonstrated strong CFA indices with KMO (0.72) and bartlett's test ($p=0.001$). Cost and relative advantage showed a convergent validity (AVE= 0.706, AVE=0.505) respectively. The regression model was significant ($F=159.6$, $p<0.001$), explained 72% of the variance of the dependent variable ($R^2= 0.725$) and satisfied key assumptions of normality, independence and multicollinearity with only minor deviations noted. The proportional odds assumption holds, indicating that the impact of the predictors on moving to higher adoption categories is consistent across all levels, supporting the reliability of the model's estimates.

Table 2

Predictor Coefficients

Predictor	Coef	Std Err	z	P>|z|

High-cost impact	-0.03	0.1	-0.3	0.766
Positive cost influence	0.065	0.116	0.56	0.576
Complexity restriction	-0.005	0.113	-0.05	0.964
Perceived complexity	-0.042	0.213	-0.2	0.843
Relative advantage	-0.011	0.164	-0.07	0.947

Table 3

Significant Thresholds

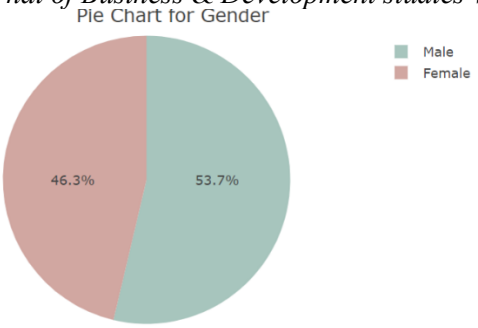
Threshold	Coef	Std Err	z	P>|z|
2.0 / 3.0	-2.501	0.572	-4.37	0.0
3.0 / 4.0	-1.015	0.257	-3.95	0.0
4.0 / 5.0	-0.354	0.176	-2.01	0.044
5.0 / 6.0	-3.644	0.997	-3.65	0.0
6.0 / 7.0	-0.494	0.207	-2.39	0.017
7.0 / 8.0	-0.535	0.25	-2.14	0.032
8.0 / 9.0	-0.815	0.348	-2.35	0.019

Inferential Statistics Results

Demographic Information

The study gathered data on the demographics of the respondents focusing on the gender, the age group and the position the respondents held within the retail pharmacy. The study also focused on the turnover of the retail outlet and number of years they have been in operation.

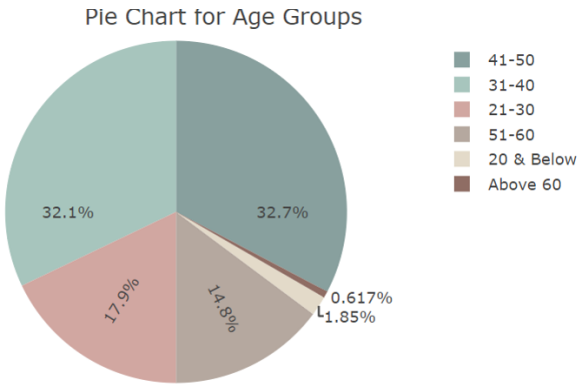
Gender



Gender of the Respondents

The gender distribution of respondents showed that 93 males (53.7%) made up a slightly larger proportion than 69 females (46.3%). The slight majority of male respondents aligns with industry employment patterns observed in many professional settings, offering contextually appropriate representation. The gender distribution additionally enhances confidence that the findings represent the reality of the sector as compared to when the gender is skewed in one direction. This suggests that the perspectives gathered in this study are inclusive of both genders enhancing the generalizability of the findings across both male and female stakeholders within the retail pharmaceutical sector in Nairobi.

Age group



Age of the respondents

The age distribution of respondents indicated that the majority, 105, fell within the 31-40 (32.1%) and 41-50 (32.72%) age brackets, suggesting that middle-aged professionals made up the largest share. The 21-30 age group (17.9%) represented a significant portion, 28, while those in the 51-60 range (14.81%) constituted a smaller share, 23. Younger respondents, specifically those aged 20 and below (1.85%), and older respondents aged Above 60 (0.62%), had minimal representation. The age of the respondents enriches the study, since it established that the findings gathered were mainly from individuals who possessed a deeper understanding of the sector's nuances. Respondents in the 31-50 age group tend to have typically amassed extensive professional experience, going beyond entry-level positions into ranks that have more involvement in strategic planning, operational oversight, and key

decision-making. Their deep understanding of the retail pharmaceutical landscape in Nairobi has been built over the years, giving them an opportunity to provide more detailed perspectives

on the ever-changing competitive pressures, technological adoptions, and shifts in consumer behavior.

Technological factors

Table 4

Frequencies of factors that make up Technological factors

	Variable		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
COST	Investing in e commerce has been financially justified by the competitive benefits it provides	Count	34	16	0	44	68
		%	20.99	9.88	0	27.16	41.98
	The costs linked to e commerce adoption have positively influenced our competitive advantage through reduction of operational expenses	Count	14	9	28	56	48
		%	8.64	5.56	17.28	34.57	29.63
	High cost of e commerce implementation has impeded our ability to use it as tool for competitive advantage	Count	24	4	28	44	62
		%	14.81	2.47	17.28	27.16	38.27
COMPLEXITY	Despite its complexity e commerce adoption has enabled us to enhance our competitive advantage by facilitating better business operations	Count	0	14	0	91	68
		%	0	8.64	0	56.17	41.98
	The perceived complexity of e commerce tools impacts our company s capability to innovate and maintain a competitive edge	Count	0	0	28	90	90

		%	0	0	17.28	55.56	55.56
	The complexity of e commerce systems has restricted our capability to leverage on it as a source of competitive advantage	Count	0	77	17	31	37
		%	0	47.53	10.49	19.14	22.84
RELATIVE ADVANTAGE	E commerce adoption has facilitated us with timely insights that support our decision making and competitive advantage	Count	0	0	16	98	28
		%	0	0	9.88	60.49	33.95
	The relative advantage of e commerce such as customer segmentation and niche marketing has improved our competitive positioning	Count	0	0	40	43	79
		%	0	0	24.69	26.54	48.77
	Our use of e commerce has substantially contributed to our ability to differentiate ourselves from competitors	Count	0	0	11	61	57
		%	0	0	6.79	37.65	35.19
							44
							27.16

Table 5

Correlation between Technological factors and competitive advantage.

Spearman's rank correlation rho	0.156
p-value	0.046
Fisher's Exact Test for Count Data(p-value)	0.052

The analysis indicates a weak yet statistically significant positive correlation between technological factors and competitive advantage, as shown by Spearman's rank correlation ($\rho = 0.156$, $p = 0.046$). While the correlation strength is moderate, the statistical significance suggests that technological factors have some influence on competitive advantage. The Fisher's Exact Test result shows a p-value of 0.052, which is slightly above the conventional threshold of 0.05 for statistical significance. This suggests that although a potential association exists between the variables, the evidence is not strong enough to be considered statistically significant at the 5% level. Additionally, while technological results may contribute to competitive advantage, their influence is limited and not consistently strong across all the statistical tests. These findings suggest that technological factors have a contributory although moderate role in influencing competitive advantage within the retail pharmaceutical sector in Nairobi.

Table 6

Chi Square test for significance

X-squared	6.7592
Df.	2
p-value	0.03

Additionally, the Chi-Squared test ($X^2 = 6.759$, $df = 1$, $p = 0.03$) confirms a strong association between these variables, highlighting that technological factors significantly influence competitive advantage. The test indicates a statistically significant p-value of 0.03 providing robust evidence of a strong relationship between technological factors and competitive advantage, more-so when these variables are considered in categorical terms.

Table 7

Ordinal logistic regression between Technological factors and competitive advantage

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-5.784	2.784	-2.077	0.037
Technological factors	0.876	0.684	1.281	0.200

The results of the ordinal logistic regression indicate that technological factors are not statistically significant predictors of competitive advantage. The intercept value of -5.784 suggests that the retail pharmacies have a lower chance of achieving competitive advantage if they do not put into consideration the technological factors. However, with (p=0.200), technological factors do not significantly predict competitive advantage in this model.

Table 8

Ordinal logistic regression between factors that make up technological factors and competitive advantage

	Estimate	Std. Error	z value	Pr(>|z|)

(Intercept)	-8.007	3.205	-2.498	0.012
Cost	0.293	0.521	0.563	0.573
Complexity	0.765	0.442	1.729	0.083
Relative advantage	0.377	0.326	1.157	0.246

The results of the ordinal logistic regression indicate that technological factors, including cost, complexity, and relative advantage, do not have a significant influence on competitive advantage. This suggests that variations in these technological factors do not play a decisive role in shaping competitive success within the dataset analyzed.

Discussion of Results

Influence of Technological Factors on Competitive Advantage

The study sought to establish the influence of technological factors on competitive advantage in retail pharmacies in Nairobi. The results of the Pearson correlation analysis ($\rho = 0.156$, $p \leq 0.05$) indicated a positive, albeit weak, linear relationship between technological factors and competitive advantage, suggesting that improvements or advancements in technological capabilities are modestly associated with enhancements in competitive positioning. Furthermore, the chi-square test of association ($\chi^2 = 6.759$, $df = 1$, $p \leq 0.05$) revealed a statistically significant association between the two variables, implying that the presence or absence of technological factors is related to variations in competitive advantage.

However, despite these indications of association and correlation, the results from the ordinal logistic regression analysis showed that technological factors do not have a statistically significant predictive effect on competitive advantage when considered within a multivariate framework. The results partially align with the TOE framework which emphasizes that technological factors are a key driver of innovation adoption and firms' performance. This finding suggests that while technological factors may be linked to competitive advantage at a descriptive level, they do not independently account for significant variations in competitive outcomes when other variables are considered. These findings imply that although technology may be a vital component of the competitive landscape in retail pharmacy, it may not, in isolation, serve as a decisive determinant of competitive advantage.

Conclusion

Influence of Technological Factors on Competitive Advantage

The results of the Pearson correlation analysis ($\rho = 0.156$, $p \leq 0.05$) indicated a positive, albeit weak, linear relationship between technological factors and competitive advantage. Chi-square test of association ($\chi^2 = 6.759$, $df = 1$, $p \leq 0.05$) revealed a statistically significant association between the two variables, implying that the presence or absence of technological factors is related to variations in competitive advantage. This finding suggests that while technological factors may be linked to competitive advantage at a descriptive level, they do not independently account for significant variations in competitive outcomes when other variables are considered.

Hence this led to the conclusion that technological factors do not necessarily drive the retail pharmacies towards competitive advantage.

Recommendations

Influence of Technological Factors on Competitive Advantage

The results suggest that while technological factors contribute to operational efficiency, they do not independently determine competitive advantage. To achieve meaningful impact, technology adoption should be integrated with organizational strategies such as leadership alignment, staff capacity building and process innovation to be able to translate efficiency gains to sustainable competitive advantage outcomes.

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