

TECHNOLOGY ASSIMILATION AND COMPETITIVENESS OF FOOD AND BEVERAGE MANUFACTURING COMPANIES IN NAIROBI COUNTY, KENYA

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ABSTRACT

The business environment is changing, and it is clear from the trend that this creates challenges every day. Thus, food and beverage firms must embrace strategic management drivers that involve applying creative thinking to develop distinctive brands and client-friendly goods and services to gain a competitive advantage in terms of product preference on consumer assurance. This study sought to establish the effect of technology assimilation on the competitiveness of food and beverage manufacturing industries in Nairobi City County, Kenya. The study was supported by the technology acceptance model. The study utilized descriptive research methodology targeting 119 food and beverage firms with a sample size of 256 managers of the firms. The study utilized primary and secondary data. Primary data was gathered using structured questionnaires, while secondary data were sourced from the F&B Company's financial records, KAM, and KNBS. The study targeted F&B manufacturing firms' management, which includes finance, marketing, operations, human resources, risk and compliance, and information and

communication technology. Data was analyzed through descriptive and inferential statistics. A pilot study of 10% of the sample was conducted before the actual study. Multiple regression models were applied. The findings revealed that technology assimilation had a positive and statistically significant effect on competitiveness ($\beta = 0.289$, $p < 0.001$). The regression model indicated a strong relationship ($R = 0.801$) and explained 64.2% of the variation in competitiveness ($R^2 = 0.642$). The study concludes that technology assimilation significantly enhances the competitiveness of food and beverage manufacturing firms. The study recommends that firms should prioritize technological investment to improve performance. Policymakers should also create an enabling environment that supports innovation and capacity building in the manufacturing sector.

Key words: Technology Assimilation, Competitiveness, Food and Beverage Manufacturing Companies in Nairobi County, Kenya.

INTRODUCTION

Background of the Study

The current state of the business climate may be summed up in four words: volatile, uncertain, complex, and ambiguous (VUCA). Firms must be able to recognize market opportunities and threats and respond to them swiftly and promptly to survive in such an environment (Huang, Ouyang, Pan & Chou, 2025). To increase its competitiveness, the company needs to possess competencies in an array of functional areas, administrative tasks, or areas of specialization; thus, strategic drivers are essential for improving organizational competitiveness (Hambali, Sukma, & Sarumpaet, 2024). Strategic management is the art of implementing strategic and intentional corrective actions to meet an organization's long-term objectives has grown in prominence due to its crucial role in economic performance (Chuang, 2015).

According to Rehman et al. (2020), technology assimilation has been termed as the firm's necessary capacity to fully integrate, utilize, modify, and produce technology for usage. The ability of a company to apply new technological knowledge for engineering, production, and innovation to become competitive in terms of both quality and price is another definition of technology assimilation. Technology is extremely important to businesses and aids in their adoption, adaptation, and utilization of new technology. Among the tools available to the company to improve its competitive position, technology use is crucial and plays a major role in the company's performance in terms of increasing its market competitiveness. In today's society, technology is acknowledged as a major factor in achieving organizational objectives. IT is used to implement key elements of strategy while maintaining the ability of stakeholders to exchange information.

Every plan that a contemporary organization wants to put into practice begins with thorough research and consideration of its ramifications; technology exists to facilitate this process (Gyebi & Quain, 2013). A company's outstanding and diverse technical resources, closely linked to design, product, information, and process technologies, as well as the sourcing and integration of outside expertise, are its technical competencies (Bergek, Tell, Berggren, & Watson, 2008). Considerable improvement in a company's performance can be attributed to these technical capabilities (Bergek et al., 2008). Superior performance can be achieved by a firm through the identification, acquisition, and use of fresh external knowledge to develop operational competence, made possible by technical capabilities. A company can develop and deliver new products and services more effectively and efficiently by using its technical capabilities.

This improves the firm's performance and overall success in developing new products (Wang et al., 2006). Therefore, technological aptitude helps insurance companies to withstand the consequences of a dynamically changing business environment at every stage of the company's life, from the beginning to the age of CSR. Effective technology development in insurance firms requires being adaptable to changes in the technology landscape, continuously gaining important

knowledge, and skillfully applying existing technologies (Ahmad et al., 2014; Bergeek et al., 2008; Wang et al., 2006). As a result, the firm's technical competency is strengthened when suitable operational capabilities are combined effectively. Research has shown that technological capabilities enable businesses to create and provide customers with valuable products or services, as well as to maintain effective customer relationships that improve performance (Reichert & Zawislak, 2014; Ahmad et al., 2014; Zawislak et al., 2013; Wang et al., 2006).

Falciola, Jansen, and Rollo (2020) define firm competitiveness as an organization's capacity to deliver goods and/or services that are superior to those of its rivals or that are of comparable quality but more affordable. This implies that for an organization to become more competitive, it must either invest in systems and procedures to improve quality or concentrate on cost-cutting measures to reduce production costs while maintaining a level of quality comparable to its competitors. According to Baark, Lau, Lo, and Sharif (2018), firms rely on several elements to attain competitiveness, including cost differentiation, market efficiency, diversification, mergers, acquisitions, and strategic alliances. In terms of competitiveness, these factors put the company in a position to expand into new markets and produce high-quality goods at reduced prices, which raises the company's standing. Utilizing strategic management driver elements such as technology and innovation, as well as enhancing human resources and organization structure, are other approaches that modern organizations pursue to gain competitiveness (Ortiz & Pacheco, 2017).

Statement of the Problem

The manufacturing sector is one of the key engines driving Kenya's economic growth, accounting for approximately 70% of the industrial sector's GDP contribution and serving as a critical pillar in Kenya's Vision 2030 (KIPPRA, 2022). Within this sector, the food and beverage (F&B) subsector plays a vital role. However, in recent years, the subsector has faced significant performance challenges, including fluctuations in profitability, market share, and sales growth (Abade et al., 2024; Nzomo & Wachiuri, 2023; Widjaja, 2024). According to KPMG (2021) and KAM (2020), the F&B subsector recorded an average annual real growth rate of 4.1% between 2015 and 2023, falling short of the targeted 4.6%. Profitability trends have also shown volatility, with profit margins ranging from 11.8% in 2017 to a low of 8.4% in 2023. Sales volumes decreased significantly between 2017 and 2020, before briefly improving in 2021, and then declining again in 2022 and 2023 (KAM, 2022; KAM, 2024). This deteriorating performance has led to drastic outcomes, including the closure and downsizing of major firms. For instance, Cadbury Kenya shut down operations after a 58.7% drop in net profits. Eurofood Limited and Kune Foods Ltd ceased operations due to declining sales, while Alpha Fine Foods Ltd and TSS Grain Millers Ltd downscaled (KAM, 2023). Coca-Cola Ltd also reported a loss of KES 1.7 million in 2018 due to inventory errors. KAM (2023) attributes this underperformance to a highly unpredictable operating environment, driven by high taxes, elevated production costs, expensive industrial inputs, the influx of low-priced imports and counterfeit goods, financing challenges, and foreign exchange volatility. Macroeconomic factors such as a decline in GDP growth, a widening trade imbalance,

and the exit of multinational firms have further compounded the sector's woes (Mbugua et al., 2024). Food production activities that indicated reductions include processed and preserved fish (-3.8%), grain mill products (-6.4%), bakery products (-3.5%), dairy products (-5.7%), beverages (-16.7%), and coffee processing (-12.6%). Despite these challenges, there is a strong belief that strategic drivers can help F&B firms navigate turbulent conditions and build competitive advantage. However, while technology assimilation have been widely studied in Kenya, few studies have focused specifically on the F&B manufacturing subsector, presenting a contextual gap. For instance, Waheti (2020) examined commercial banks, Muthoka (2017) focused on state corporations, Maroa and Muturi (2015) studied floriculture firms, Kimanjara et al. (2024) researched the Catholic Diocese of Nakuru, Opwolo (2018) targeted real estate firms, while Muriithi (2017) looked into confectionery firms. None of these studies touched on F&B manufacturing firms in Nairobi County. There is also a conceptual gap, as previous studies offer mixed findings. Some researchers, such as Naranjo-Valencia et al. (2016), Mwithi (2017), and Chigozi and Onyia (2018), found a negative relationship. Others, including Nungchim (2022), Ali (2017), Ghumiem (2023), and Muema (2017), reported a positive relationship, while Candia et al. (2017) found no significant impact. Additionally, geographical gaps exist; some of these studies were conducted outside Kenya. For instance, Nungchim's (2022) study was done in India, Ali's (2017) findings were based in Egypt, Zhang and Chen's (2022) in China, and Chigozi and Onyia's (2018) study was based in Nigerian manufacturing firms, making it difficult to generalize their findings due to differences in legal and economic environments. Lastly, existing studies have employed varied variables. For instance, Muriithi (2017) focused on product diversification and customer relationships, while Mutindi (2015) emphasized strategic positioning and planning. In contrast, the present study proposes to examine the effect of technology assimilation on the competitive advantage of F&B firms in Nairobi County, Kenya. Given the declining competitiveness of F&B manufacturing firms and the mixed findings from previous research, it is unclear what technology assimilation influence performance in this context. Furthermore, limited research has targeted F&B firms in Nairobi County using the variables proposed in this study. Based on this, the current study's aim was to fill this gap and answer the question: Do technology assimilation have any influence on the competitiveness of food and beverage manufacturing firms in Nairobi County, Kenya?

Objective of the Study

The objective of the study is to study the effect of technology assimilation on the competitiveness of food and beverage manufacturing companies in Nairobi County, Kenya.

THEORETICAL REVIEW

This section presents a literature review that emphasizes an empirical review and critical analysis of the body of existing literature

Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Fred Davis in 1989. The model states that the adoption of any technology by firms or organizations is significantly dependent on perceptions about the usefulness and ease of use of the technology. According to Davis (1989), a user's conviction that utilizing technology will improve their performance, worthiness, or general well-being is known as perceived usefulness. Additionally, Davis (1989) defines perceived technology ease of use as the user's belief that the technology would be effortless to use. The Technology Acceptance Model (TAM) suggests that the two factors, perceived utility and ease of use, define the user's behavior before technology adoption. Organizations that believe that technology will enhance their overall performance ultimately decide to implement it. Additionally, businesses that believe that implementing any technology can save expenses and increase resource deployment will eventually use it.

In the TAM, in the process of adopting technology, perceived benefit is a factor that is commonly used. According to Barata and Cain (2011), it is the degree to which a consumer's improvement in productivity would result from utilizing this new technology. If customers think using Fintech might be advantageous, they will choose a service based on perceived usefulness (Kariuki, 2018). The Technology Acceptance Model (TAM) assumes that if people believe a technology is practical and simple to use, they will embrace and utilize it. The behavioral intention that propels this acceptance is impacted by perceived utility and perceived usability. TAM asserts that people are more likely to accept and use a technology if they believe it to be useful and easy to use (Ajibade 2018). According to Lee (2025), the two most important presumptions that completely mediate the influence of TAM are perceived usefulness (PU) and perceived ease of use (PEOU). The Technology Acceptance Model (TAM) has been criticized for being too general and limited, especially in terms of its incapacity to adequately represent the complexity of adopting technology in numerous contexts. According to Barata and Cain (2011), TAM ignores other important aspects like social influence, facilitating conditions, and even issues like cost and structural imperatives in favor of focusing solely on perceived usefulness and perceived ease of use, which is considered restrictive. Additionally, Barata and Cain (2011) examine how TAM's narrow focus on individual user views may not fully address the intricacies of technology acceptance in corporate or institutional settings where organizational rules and considerations are important. Sadeck (2022) contends that TAM may not fully account for the cultural and contextual subtleties that can affect how technology is accepted in various societies and contexts and that the model depends on subjective measures of behavior like intention, which may not always translate to actual usage, especially in observed settings.

Similarly, Rahimi (2024) argues that the model's explanatory power is limited and that it offers little insight into actual technology usage because it focuses on intended use rather than actual use. Despite the contention, numerous empirical studies on the adoption of information technology over the past decade have found that perceived usefulness based on TAM can positively affect

users' intentions (Barata and Cain, 2011; Otieno, Migiro, and Mutambar, 2017). Memba and Feng (2016) assert that financial managers and organizations can make wise financial decisions due to the use of blockchain technology and its perceived ease and efficiency. Worthington (2021) underscores the importance of TAM as an important model that can be applied in understanding and forecasting the adoption and usage of new technologies by users, especially in organizational and business settings.

Kelly (2023) supports that TAM assists marketers and designers in determining the elements that impact user behavior and creating plans for the effective application of technology. By emphasizing perceived utility and perceived usability, TAM offers a framework for comprehending why consumers may accept or reject novel solutions. By recognizing that technology is a strategic driver for any organization based on its applicability and the benefits it offers, the Technology Acceptance Model (TAM) will be used in this study to identify the effects of technology on firm competitiveness. This suggests that F&B manufacturing companies are more inclined to implement a competitive advantage if they believe that technology would improve overall operational performance. Therefore, this study applied this theory to assess how much perceptions of the utility and usability of these technologies affect the firm competitiveness of F & B manufacturing companies in Nairobi County, Kenya.

Conceptual Framework

The conceptual framework illustrates how the independent variable and the dependent variable under investigation are related.

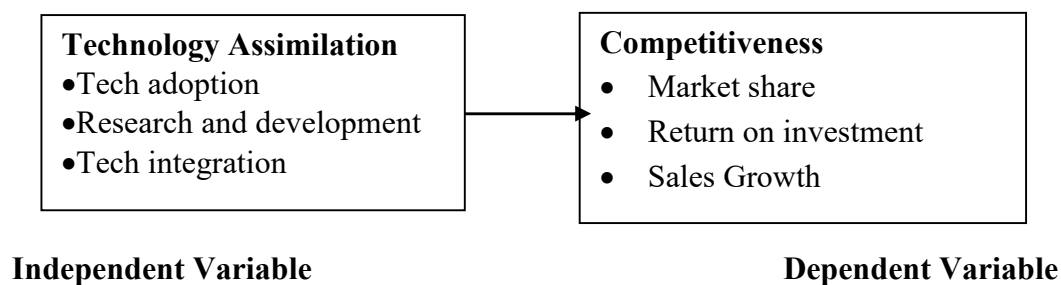


Figure 2.1: Conceptual Framework

Empirical Review

Rahim and Zainuddin (2019) aimed to ascertain the extent to which technological innovation influences firm competitiveness and overall performance of Malaysian automotive manufacturers. The manufacturing, R&D, HR, and networking capacities were the dynamics that were taken into account in the study. The study used interviewing and surveying techniques to gather information from automobile firms. The partial least squares method was used to analyze the data with the aid of Warp PLS 6.0 software. The study's conclusions showed that the firms' performance and competitive advantage were enhanced by their networking and R&D. The conclusion was that

technology affects firm competitiveness and the overall performance of automotive manufacturers in Malaysia.

Tariq et al. (2019) investigated the moderating effect of technology orientation on the relationship between organizational learning capability, process innovation, product innovation, and the performance of small and medium-sized firms (SMEs) in Pakistan. Data was collected from a population of 1135 employees working in software houses in Pakistan, and a simple random sampling technique was used after checking the questionnaire; only 478 useable questionnaires were included for analysis. The study utilized a quantitative descriptive research design to analyze the mean, standard deviation, and variance, while inferential analysis through correlation and regression analysis was employed to analyze the impact of technology orientation on performance in software houses located in Pakistan. The research discovered that technology orientation influences the financial performance of small and medium-sized firms (SMEs) in Pakistan.

Haabazoka (2019) did a study of the effects of technology assimilation on commercial banks' performance in underdeveloped nations: An analysis of the banking sector in Zambia. Automated Teller Machines (ATMs), mobile banking, and Internet banking were all examined in the study. All 19 of Zambia's commercial banks' combined data were used in the study. The impact of the innovations on the commercial bank's performance, as determined by its revenue, was examined. The study used monthly data over four years. In this study, a descriptive research design was employed. The Bank of Zambia and several audited financial and other statements of distinct commercial banks were the sources of secondary data. Data analysis was done using SPSS software. The results showed that Zambian commercial banks' financial performance benefited from bank technology advancements.

Kiiru et al. (2022) conducted a study that investigated the effect of technology and operational efficiency of small and medium-sized animal feed production enterprises in Kenya. The study combined qualitative and quantitative methods in a cross-sectional research design. A sample size of 65 directors and 65 managers took part in the study as respondents, and the research used a census methodology to gather data. Both descriptive and inferential statistics were used to analyze the data. The results of the study point to a strong and favorable relationship between technology and the operational effectiveness of Kenyan small and medium-sized animal feed manufacturing businesses. According to the study, people must possess technical skills that can significantly improve performance as a whole. Because the study only looked at small and medium-sized animal feed production businesses in Kiambu County, it identified a research gap within its contextual framework.

RESEARCH METHODOLOGY

This study adopted a descriptive research design. The population of the study was food and beverage manufacturing firms in Nairobi County, Kenya. The population consisted of 119 food and beverage companies in Nairobi County, Kenya, as per the KAM (2024) report. The study targeted F&B manufacturing firms' management, which includes finance, marketing, operations, human resources, risk and compliance, and information and communication technology managers. The managers from each of the 119 F&B manufacturing firms served as the unit of observation that participated in the study. The list of the 119 F&B manufacturing firms in Nairobi County, Kenya, as per the KAM report (2024). The sample frame consisted of 714 managers from various departments of the F&B manufacturing company. The study utilized a purposive sampling method to pick the sample.

The study employed purposive sampling because it targets the sample that has the same characteristics, for instance, each food and beverage manufacturing firm's management, which includes finance, marketing, operations, human resources, risk and compliance, and information and communication technology management. The study collected primary data supported by the questionnaire on strategic management drivers and secondary data on competitiveness using a data collection sheet. The questionnaire was structured into sections covering the variables of the study. Some of the items on the questionnaire were designed using a five-point Likert scale, where 1 strongly disagrees, and 5 strongly agree.

The pilot study was done before the actual study to test for the reliability and validity of the research instrument. The study used 10% of the sample size to carry out the pilot test. This gave a total of 26 respondents. The research employed face, content, and construct validity to evaluate the validity of the questionnaires. Construct validity was measured through Explanatory Factor Analysis (EFA) to understand the underlying relationships between questionnaire items and the factors (constructs) measured by a questionnaire. (Ghauri, Grønhaug & Strange, 2020). The reliability of the questionnaire was determined through the computation of the Cronbach Alpha Coefficient values. This figure was determined from the filled questionnaires in a pilot study. The value 0.7 was considered as a threshold (Rousson, Gasser, & Seifer, 2012).

The analysis of the gathered information was supported by STATA version 18. The values of means and standard deviations were utilized as descriptive statistics. Inferential analysis through a regression model and correlation analysis was used to establish the effect of strategic management drivers on the competitiveness of F&B manufacturing firms in Nairobi County, Kenya. The analytical model is as specified below:

$$Y = \alpha + \beta_1 X_1 + \epsilon \dots \dots \dots \text{Equation 1}$$

Where:

Y represents the competitiveness of F&B manufacturing companies in Nairobi County.

α represents a constant
 β_1 represents the beta coefficients
 X_1 represents technology assimilation
 ε represents the error term

RESEARCH FINDINGS AND DISCUSSION

This section presents the analysis, findings, and discussion of the data collected on technology assimilation and competitiveness of food and beverage manufacturing companies in Nairobi County, Kenya.

Response Rate

The study targeted a total of 256 respondents drawn from food and beverage manufacturing companies in Nairobi County, Kenya. Out of these, 220 questionnaires were completed and returned, while 36 were not returned, resulting in a response rate of 86%. The summary is summarized in Table 4.1

Table 4: 1 Response Rate

Response Rate	Frequency	Percent
Questionnaires Administered	256	100
Questionnaires Returned	220	86
Questionnaires Not Returned	36	14
Total	256	100

The high response rate of 86% indicates strong participation from respondents and reduces the likelihood of non-response bias. The rate is consistent with the assertion of Willimack (2002), who suggested that a response rate ranging 50% to 90% is adequate for analysis.

Demographic Characteristics of Respondents

This section presents the demographic characteristics of the respondents who participated in the study. The demographic variables analyzed included gender, age, level of education, management level, and years of experience.

Gender of Respondents

This section presents the distribution of respondents by gender.

Table 4.2 Gender of Respondents

Gender	Frequency	Percentage (%)
Male	132	60
Female	88	40
Total	220	100

The findings indicate that 60% of the respondents were male, while 40% were female. This suggests that the food and beverage manufacturing sector is relatively male-dominated, although there is notable female representation, indicating increasing gender inclusivity in management roles.

Age of Respondents

This section presents the distribution of respondents by age brackets.

Table 4.3. Age of Respondents

Age Bracket (Years)	Frequency	Percentage (%)
20 – 30	44	20
31 – 40	88	40
41 – 50	55	25
Above 50	33	15
Total	220	100

The majority of respondents (40%) were aged between 31 and 40 years, followed by those aged 41–50 years (25%). This indicates that most respondents were within the productive and experienced workforce, capable of providing informed responses on strategic management practices.

Level of Education

This section presents the educational qualifications of the respondents. The findings are shown in Figure 4.4.

Table 4.4: Level of Education

Education Level	Frequency	Percentage (%)
Diploma	44	20
Bachelor's Degree	110	50
Master's Degree	55	25
PHD	11	5
Total	220	100

The results show that the majority of respondents (50%) held a Bachelor's degree, while 25% had a Master's degree. This indicates a highly educated workforce, suggesting that respondents had sufficient academic background to understand and respond to the study questions effectively.

Management Level

This section presents the respondents according to their management level within the organization.

Table 4.5: Management Level

Management Level	Frequency	Percentage (%)
Top Management	66	30
Middle Management	99	45
Lower Management	55	25
Total	220	100

Most respondents (45%) were from middle management, followed by top management (30%). This indicates that the study captured insights from key decision-makers and implementers of strategic management practices.

Years of Experience

This section presents the respondents based on their work experience. The number of years worked was grouped into 4: Less than 5 years, between 5 and 10 years, between 11 and 15 years, and over 15 years.

Table 4.6: Years of Experience

Years of Experience	Frequency	Percentage (%)
Less than 5 years	33	15
5 – 10 years	77	35
11 – 15 years	66	30
Above 15 years	44	20
Total	220	100

The majority of respondents (35%) had 5–10 years of experience, while 30% had 11–15 years. This indicates that most participants had adequate experience in the industry, enhancing the reliability and credibility of the data collected.

Pilot Study Results

A pilot study was undertaken to pre-test the questionnaire using the same procedures and techniques intended for the main research.

Reliability Results

The study generated the overall reliability test for each construct.

Table 4.7. Reliability Coefficient

Dimensions	No. of Items	Cronbach's Alpha Coefficient
Competitiveness	8	0.833
Technology Assimilation	6	0.826

Table 4.4 indicates the Cronbach's Alpha Coefficient of 0.833 and 0.826, which was found to be very good, and hence the research instrument was reliable for the current study.

Face Validity

Face validity was conducted, and the questionnaire was reviewed by the supervisor. The supervisor checked the clarity, readability, and appropriateness of the questions for the target respondents. Unclear questions were reframed, some questions added, and others discarded. Feedback from the pilot study respondents was used to rephrase ambiguous questions, remove redundant items, and improve overall flow.

Content validity

The study utilized the relevant literature for concepts and other research instruments created by other researchers in studies that are connected to the current study. The selected items were carefully compared to the subject domain by the supervisor to verify the research's content validity. A review of the instruments' content coverage according to the study parameters was conducted by the supervisor. Peers were also given the tools to examine further in order to assess internal consistency. Based on the supervisor's comments, the researcher improved the instruments.

Test for Sampling Adequacy

Before conducting the EFA, the study conducted the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity to assess whether the pilot sample was suitable for factor analysis. The results of the sample adequacy are portrayed in Table 4.8.

Table 4.8: KMO (1974) and Bartlett's (1951) Test Results

Test	Value	Interpretation
Kaiser-Meyer-Olkin (KMO)	0.860	Meritorious; sample adequate for factor analysis
Bartlett's Test of Sphericity	$\chi^2 = 654.27, df = 210, p < 0.001$	Significant correlations are sufficient for factor analysis

From the findings in Table 4.8, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.860, which surpasses the minimum acceptable value of 0.60 recommended by Kaiser (1974) and falls within the adequate range (0.80–0.89) as classified by Hutcheson and Sofroniou (1999). This indicates that the sample size and the correlations among variables were sufficient to produce distinct and reliable factors. Furthermore, Bartlett's Test of Sphericity yielded a statistically significant result ($\chi^2 = 654.27, df = 210, p < 0.001$), confirming that the correlation matrix was not an identity matrix and that there were adequate interrelationships among the variables for factor extraction (Field, 2013). Together, these results affirm that the dataset met the prerequisites for

factor analysis, thereby supporting the adequacy of the instrument in measuring the intended constructs.

Construct Validity

Explanatory Factor Analysis (EFA) was used in the current study to assess construct validity in order to determine the underlying linkages between the factors (constructs) that a questionnaire measures and the items on the questionnaire. The results are indicated in Table 4.9.

Table 4.9. KMO (1974) Factor Analysis Test of Construct Validity

Communalities		
Technology Assimilation	Initial	Extraction
New technologies are easily adopted	1	0.611
ICT adoption enhances competitiveness	1	0.711
Technology improves production speed	1	0.971
Technology provides a competitive advantage	1	0.856
Automation reduces costs and errors	1	0.976
Employees are trained in ICT use	1	0.721
Average	1	0.808
Competitiveness of F&B Manufacturing Firms	Initial	Extraction
Profitability has improved due to the organizational culture	1	0.641
Firms offer competitive products and services	1	0.632
Technology has improved returns	1	0.789
Competitive policies are in place	1	0.745
Strategic drivers contribute to high profits	1	0.671
The firm offers distinguished products and services to customers	1	0.863
Strategic practices enable the achievement of targets	1	0.852
Customer satisfaction enhances competitiveness	1	0.896
Average	1	0.761

Extraction Method: Principal Component Analysis

To test the construct validity of technology assimilation, the six (6) measurement items were equally subjected to factor loadings. From the results, all the measurement items had average factor loadings of 0.808 above the minimum threshold of 0.40 extracted, implying that the data sample was sufficient for analysis.

Lastly, the competitiveness of F&B manufacturing companies in Nairobi County, Kenya, was measured using eight (8) measurement items, which were subjected to factor loadings. The results presented in Table 4.2 above indicate that all the measurement items had a mean factor loading of 0.761, which was above the minimum threshold of 0.40 extracted, implying that the competitiveness measurement items are sufficient measures for analysis. From the results, the five factors together explain an average of 0.634 (63.4%) of the total factor loadings, indicating that the selected items effectively capture the underlying dimensions of strategic management drivers and competitiveness. Therefore, according to KMO (1974) Factor Analysis Test of Construct Validity, the study can conclude that all the measurement items had met the minimum threshold of validity test and thus can be relied upon to assess the majority of the changes in the strategic management drivers (Thao et al., 2022).

These findings are consistent with previous empirical studies. For instance, Mutiso et al. (2020) found that a five-factor structure explaining 61.2% of the variance adequately measured leadership direction and competitiveness in Kenyan manufacturing firms. Similarly, Omondi and Muturi (2019) reported that factors explaining over 60% of variance met construct validity requirements when assessing organizational culture and performance in public institutions. Thao et al. (2022) also documented that a variance explained above 60% was sufficient to validate measurement instruments in business competitiveness studies in Vietnam. In the context of SMEs, Nyamu and Wanyoike (2021) concluded that 63% variance explained in PCA results indicated strong construct validity in assessing technological adoption and market performance.

Descriptive Statistics Results

This section presents the descriptive statistics of the study variables, namely organizational culture, strategic leadership, technology, strategic resources, and competitiveness of food and beverage manufacturing firms. The analysis focuses on the mean and standard deviation to establish the central tendency and dispersion of responses. The Likert scale ranged from 1 (Strongly Disagree) to 5 (Strongly Agree).

Technology Assimilation

This section presents descriptive statistics on technology assimilation in the firms

Table 4.12: Technology Assimilation

Statement	Mean	Std. Dev
New technologies are easily adopted	3.90	0.85
ICT adoption enhances competitiveness	4.10	0.73
Technology improves production speed	4.18	0.69
Technology provides a competitive advantage	4.20	0.68
Automation reduces costs and errors	4.05	0.75
Employees are trained in ICT use	3.95	0.80
Average	4.06	0.75

Technology recorded a mean score of 4.06, indicating that respondents agreed that the adoption and use of technology enhances operational efficiency and contributes to competitive advantage.

This suggests that firms are increasingly leveraging ICT, automation, and digital tools to improve production processes and overall performance. The standard deviation of 0.75 shows moderate consistency in responses. While most respondents agreed on the importance of technology, slight variations suggest that the level of technological adoption may differ across firms.

Competitiveness of F&B Manufacturing Firms

This section presents descriptive statistics on the competitiveness of food and beverage manufacturing firms.

Table 4.14: Competitiveness of F&B Manufacturing Firms

Statement	Mean	Std Dev
Profitability has improved due to the organizational culture	4.08	0.74
Firms offer competitive products and services	4.15	0.70
Technology has improved returns	4.12	0.71
Competitive policies are in place	4.05	0.75
Strategic drivers contribute to high profits	4.18	0.69
Strategic practices enable the achievement of targets	4.20	0.68
Customer satisfaction enhances competitiveness	4.25	0.65
Average	4.15	0.70

The dependent variable, competitiveness, recorded a mean of 4.15, indicating that respondents strongly agreed that their firms are competitive in terms of profitability, product quality, customer satisfaction, and overall performance. This high mean suggests that strategic management practices are effectively contributing to firm success. The standard deviation of 0.70 indicates low variability, meaning that respondents had similar perceptions regarding the competitiveness of their firms. This consistency enhances the reliability of the findings and suggests that competitiveness is a common outcome across the firms studied.

Descriptive Statistics of Secondary Data

This section presents descriptive statistics derived from secondary data on the competitiveness of food and beverage (F&B) manufacturing firms in Nairobi County, Kenya.

Table 4.15: Descriptive Statistics of Competitiveness Indicators

Variable	Observations (N)	Mean	Std. Dev	Minimum	Maximum
Return on Investments (%)	220	8.45	3.12	2.10	15.80
Sales Growth (%)	220	10.20	4.05	1.50	18.60
Market Share (%)	220	12.75	5.10	3.20	25.40

The results indicate that the average ROI was 8.45%, suggesting that F&B manufacturing firms generated moderate returns from their investment base. The relatively low standard deviation (3.12) implies limited variability in asset utilization efficiency across firms. The mean sales growth rate was 10.20%, indicating that most firms experienced positive growth during the study period. However, the higher standard deviation (4.05) suggests variability in growth performance, with some firms outperforming others. The average market share stood at 12.75%, reflecting moderate

competitiveness within the industry. The wide range between the minimum (3.20%) and maximum (25.40%) values indicates disparities in market dominance among firms.

Inferential Analysis

This section presents the inferential statistical analysis used to examine the relationship between technology assimilation and the competitiveness of food and beverage manufacturing firms in Nairobi County, Kenya.

Correlation Analysis

Correlation analysis was conducted to determine the strength and direction of the relationship between the independent variables and the dependent variable.

Table 4.16: Correlation Matrix

Variable	Competitiveness	Technology Assimilation
Competitiveness	1.000	
Technology Assimilation	0.701**	1.000

Note: $p < 0.01$

The correlation results indicate that technology assimilation have a strong positive, and statistically significant relationship ($r = 0.734$, $p < 0.01$) with the competitiveness of food and beverage manufacturing firms.

Model Summary

The study conducted a multiple regression analysis to determine the combined effect of technology assimilation on the competitiveness of food and beverage manufacturing firms.

Table 4.17: Model summary

Model	Multiple R	R Square (R^2)	Adjusted R-Square	Std. Error of the Estimate
1	0.801	0.642	0.637	0.395

The results in Table 4.17 indicate that the model has a strong positive correlation coefficient ($R = 0.801$), suggesting a strong relationship between technology assimilation and the competitiveness of food and beverage manufacturing firms. The coefficient of determination ($R^2 = 0.642$) implies that approximately 64.2% of the variation in competitiveness can be explained by technology assimilation, while the remaining 35.8% is attributable to other factors not included in the model. The adjusted R^2 (0.637), which accounts for the number of predictors, is close to the R^2 value, indicating that the model is robust and not overfitted. Additionally, the relatively low standard error of the estimate (0.395) suggests that the model has good predictive accuracy.

Analysis of Variance (ANOVA)

The ANOVA test was conducted to determine the overall statistical significance of the regression model.

Table 4.18: ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig. (p-value)
Regression	52.318	3	17.439	88.76	0.000
Residual	29.051	216	0.134		
Total	81.369	219			

The ANOVA results indicate that the regression model is statistically significant ($F = 88.76$, $p < 0.001$), implying that technology assimilation have a significant effect on the competitiveness of food and beverage manufacturing firms. The calculated F-statistic is substantially higher than the critical value, and the p-value is less than the conventional threshold of 0.05, confirming that the model provides a better fit than a model with no predictors. The significance of the ANOVA test, therefore, validates the overall regression model and supports its suitability for hypothesis testing.

Regression Coefficient Results

The regression coefficients were analyzed to determine the individual contribution of technology assimilation on the competitiveness of food and beverage manufacturing firms.

Table 4.19 Regression Coefficients Results

Variable	Beta (β)	Std. Error	t-value	Sig. (p-value)
Constant	0.452	0.168	2.690	0.008
Technology Assimilation	0.289	0.067	4.313	0.000

The generated output as per multiple linear regression is as presented in Table 4.19 above. The equation is as shown below:

$$Y = 0.452 + 0.289 X_3$$

The results showed that technology assimilation has the strongest positive and statistically significant effect on competitiveness ($\beta = 0.289$, $p = 0.000 < 0.05$). Therefore, the null hypothesis was rejected, confirming that technology assimilation significantly influences firm competitiveness. This implies that firms that adopt and effectively integrate modern technologies are more likely to enhance productivity, reduce operational costs, and improve product quality, thereby gaining a competitive edge. Technology enables efficiency, innovation, and responsiveness to market demands.

This finding is supported by Nyamu and Wanyoike (2021), who found that technological adoption significantly improves performance among Kenyan SMEs. Similarly, Mutua (2025) established that ICT integration enhances competitiveness in Kenyan manufacturing firms. However, Muriithi

(2020) found that technology adoption does not always translate to improved performance due to high implementation costs and lack of technical skills, highlighting potential challenges in technology assimilation.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This section presents a summary of the key findings of the study, draws conclusions based on the research objectives, and provides recommendations for policy and practice.

Summary of Findings

The findings revealed that technology assimilation has the strongest and most significant effect on the competitiveness of food and beverage manufacturing firms. Descriptive results indicated that firms are increasingly adopting and integrating technology to improve efficiency and operational effectiveness. The correlation analysis showed a strong positive relationship between technology assimilation and competitiveness, while regression results confirmed it as the most influential predictor of firm performance. These findings imply that firms that effectively leverage technological advancements are able to enhance productivity, reduce operational costs, and improve product quality, thereby strengthening their competitive position.

Conclusions of the Study

The study concludes that technology assimilation is the most influential driver of competitiveness among food and beverage manufacturing firms. The ability to adopt, integrate, and effectively utilize modern technologies enables firms to improve operational efficiency, reduce costs, and enhance product quality. As a result, firms that invest in technological capabilities are better positioned to respond to market demands and achieve superior performance compared to those that lag in technological adoption.

Recommendations of the Study

The study recommends that firms should prioritize investment in modern technologies and ensure their effective integration into organizational processes to enhance efficiency and competitiveness. Management should focus on continuous technological upgrading and employee training to maximize the benefits of digital transformation. In addition, the government should provide incentives such as tax reliefs, subsidies, and infrastructure support to encourage technology adoption within the manufacturing sector.

Areas for Further Research

This study examined the effect of technology assimilation on the competitiveness of food and beverage manufacturing firms in Nairobi County, Kenya. The regression results indicated that the model explained 64.2% ($R^2 = 0.642$) of the variation in competitiveness, implying that 35.8% of the variation is attributable to other factors not captured in the study. Future research should

therefore explore additional variables such as innovation capability, market orientation, regulatory environment, and financial structure to provide a more comprehensive understanding of firm competitiveness.

Furthermore, the study was limited to food and beverage manufacturing firms within Nairobi County, which may restrict the generalizability of the findings. Future studies should consider other sectors and geographical regions, including cross-county or cross-industry comparisons, to establish whether similar relationships hold under different contexts. In addition, this study adopted a cross-sectional research design; therefore, future research should employ longitudinal approaches to examine how competitiveness evolves, particularly in response to technological changes and shifting market dynamics. Finally, future studies should consider incorporating moderating and mediating variables, such as firm size, organizational structure, and leadership styles, to better understand the mechanisms through which technology assimilation influence competitiveness.

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