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SUPPLY CHAIN RESILIENCE STRATEGIES AND PERFORMANCE OF TEA PROCESSING COMPANIES IN KIAMBU COUNTY, KENYA

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ABSTRACT

Tea processing companies play a crucial role in Kenya's economy, particularly in Kiambu County, where tea production and processing contribute significantly to employment and foreign exchange earnings. However, tea processing companies in Kiambu County, Kenya face several challenges that directly impact their performance. The general objective of the study is to determine the effect of supply chain resilience strategies on performance of tea processing companies in Kiambu County, Kenya. Specifically, the study sought to establish the effect of risk mapping on performance of tea processing companies in Kiambu County, Kenya and to find out the effect of technology integration on performance of tea processing companies in Kiambu County, Kenya. This study was anchored by Contingency Theory and Diffusion of Innovations Theory. This study used descriptive research design. Currently there are 66 operational tea factories under the KTDA (MS) Ltd management, each managed by a board of directors elected by and from among the growers of the specific factory catchment (KTDA, 2024). This study therefore targeted the management employees in these companies. In every company, the study targeted 1 top manager, 3 middle level managers and 5 lower level managers. The total target population was therefore 594 respondents. The study used Krejcie and Morgan (1970) formula to arrive at the sample size. The study used simple random sampling to select 170 respondents. This study also used questionnaire to collect data relevant to this study. Quantitative data collected was analyzed using descriptive statistical techniques which are frequencies, mean, standard deviation. Inferential statistics which include Pearson correlation and the Regression Analysis Model was used to test the relationship between study variables. The significance of the model was tested at 5% level of significance. Data was analysed using Statistical Package for Social Sciences (SPSS) software. The study results were presented through use of tables and figures. The study concludes that risk mapping has a positive and significant effect on performance of tea processing companies in Kiambu County, Kenya. The study also concludes that technology integration has a positive and significant effect on performance of tea processing companies in Kiambu County, Kenya. The study recommends that the management of tea processing companies in Kenya should implement a comprehensive risk mapping strategy to identify and mitigate potential risks that could impact their performance. By systematically assessing and categorizing risks, companies can proactively develop contingency plans and risk management strategies.

Key Words: Supply Chain Resilience Strategies, Risk Mapping, Tea Processing Companies, Technology Integration, Tea Processing Companies

Background of the Study

Tea is one of the most widely consumed beverages globally, and its cultivation plays a vital role in the economic, social, and cultural fabric of many countries (Alkhatib, & Momani, 2023). As an agricultural commodity, tea contributes significantly to a country's economy through exports, employment, and rural development. Countries like Kenya, India, Sri Lanka, and China are leading producers of tea, leveraging their favorable climates and skilled labor to dominate the global tea market. In Kenya, for example, tea accounts for about 23% of total export earnings, making it one of the country's most valuable export crops (KTDA, 2023). The tea industry supports millions of livelihoods, from small-scale farmers to workers involved in processing, marketing, and logistics (Arusei & Musau 2020). Beyond economic benefits, tea has a critical role in promoting sustainability and environmental conservation. Tea plantations often act as green belts, reducing deforestation in some regions. Additionally, governments and organizations use the tea sector to drive rural development through infrastructure improvements, healthcare, and education for farming communities (Jama, & Nding'u, 2024). The cultural importance of tea cannot be overlooked either, as it often symbolizes hospitality, unity, and tradition in many societies. As a globally traded commodity, tea enhances a country's foreign exchange reserves, enabling economic diversification and strengthening financial resilience (Gesese, & Singh, 2024).

Tea processing companies are businesses involved in the transformation of raw tea leaves into various processed tea products, ready for consumption. These companies typically oversee the entire tea production process, which includes plucking, withering, rolling, oxidizing (or fermenting), drying, and sometimes sorting the leaves (Bastani, *et al*, 2021). Depending on the type of tea being produced—such as black, green, white, oolong, or specialty teas—specific processing methods are employed to achieve the desired flavor and characteristics. The processed tea is then packaged and distributed to retailers, wholesalers, or directly to consumers. Tea processing companies play a pivotal role in the tea industry by bridging the gap between tea cultivation and the final consumer product (Ruamchart, 2023). These companies are responsible for transforming freshly plucked tea leaves into a range of tea products that cater to diverse consumer preferences. The role of tea processing companies begins with the collection of raw leaves from tea gardens, which are carefully handled to preserve their quality. After plucking, the leaves undergo various processes such as withering, rolling, oxidation (fermentation), and drying, depending on the type of tea being produced. For instance, black tea undergoes full oxidation, while green tea is minimally processed to retain its green color and fresh taste (Badhotiya, *et al*, 2022).

A key responsibility of tea processing companies is to ensure the quality and consistency of the tea produced. This involves strict quality control measures at every stage of the processing line. From inspecting the leaves to ensuring optimal drying times, these companies must maintain high standards to meet consumer expectations and comply with regulatory requirements Alkhatib & Momani, 2023). This is particularly important in high-demand markets where consumers expect a consistent flavor profile, color, and aroma in each batch of tea. Many processing companies also invest in research and development to innovate new tea blends or develop teas with unique health benefits, keeping the product offerings diverse and attractive. Tea processing companies are often deeply involved in ethical and sustainable practices (Noman, 2024). Many companies work closely with tea farmers to ensure fair wages, proper working conditions, and environmentally friendly cultivation techniques. Certifications like Fair Trade or Organic are often pursued to appeal to socially conscious consumers and create long-term partnerships with growers. Moreover, sustainability is a major concern, with companies exploring eco-friendly packaging and waste reduction methods to minimize their

environmental footprint. Tea processing companies are vital in distributing the finished product (Omoruyi & Makaleng, 2022). They manage the logistics of packaging and shipping, ensuring that the tea reaches retailers, wholesalers, and consumers in pristine condition. Their role is crucial in the global tea trade, as they help promote local and international markets while ensuring that tea remains a globally beloved beverage. Through innovation, quality control, and sustainable practices, tea processing companies contribute significantly to the ongoing growth and success of the tea industry (Ndode, 2024).

Supply chain resilience strategies refer to the actions and practices that organizations adopt to ensure their supply chains can withstand and recover from disruptions. These disruptions can range from natural disasters, geopolitical tensions, pandemics, to cyberattacks, and can severely affect the flow of goods and services. The goal of resilience strategies is to minimize the impact of such events, quickly adapt to changes, and return to normal operations with minimal loss (Oluleye & Akintunde, 2020). Technology integration—such as the adoption of artificial intelligence, machine learning, and blockchain—improves real-time visibility, enhances forecasting accuracy, and enables faster, data-driven responses. These technologies can optimize inventory management, improve traceability, and create a more agile supply chain capable of adapting to changes and disruptions swiftly (Kariuki, Ngugi & Odhiambo, 2023). This study aimed to determine the effect of supply chain resilience strategies on performance of tea processing companies in Kiambu County, Kenya.

Statement of the Problem

Tea processing companies play a crucial role in Kenya's economy, particularly in Kiambu County, where tea production and processing contribute significantly to employment and foreign exchange earnings. Kenya is the world's leading exporter of black tea, and the tea industry is one of the largest contributors to the country's GDP (Muricho & Muli, 2021). Tea processing companies are essential in transforming raw tea leaves into finished products that meet both domestic and international demand, making them pivotal to the country's economic growth. In addition to providing employment for thousands of people, the tea industry also supports a vast network of smallholder farmers, suppliers, and other stakeholders. The value-added products produced by tea processors enhance Kenya's position in the global market, making the sector vital to national economic development (Ndubi & Ndeto, 2024).

Tea processing companies in Kiambu County, Kenya face several challenges that directly impact their performance. These challenges are multifaceted and arise from both internal and external factors, including supply chain disruptions, market volatility, and the global competitive landscape. Profitability remains a significant concern for tea processing companies due to rising production costs and fluctuating tea prices (Mairura & Muturi, 2022). In 2022, the Kenya Tea Development Agency (KTDA) reported an 8.5% increase in the cost of producing tea per kilogram, from Ksh 36.6 to Ksh 39.7. This increase was driven by factors such as the rising cost of inputs (fertilizers, pesticides, and labor) and the surge in fuel prices, which impact transportation costs. On the other hand, the average auction price for Kenyan tea dropped by 5% in 2022, from Ksh 250 per kilogram in 2021 to Ksh 237 per kilogram in 2022 (Kariuki, Ngugi & Odhiambo, 2023). This decline is attributed to reduced global demand, especially from traditional markets like the Middle East and Europe, where Kenyan tea has faced stiff competition from countries like India and Sri Lanka. The combined effect of rising production costs and declining auction prices has squeezed profit margins, with many companies reporting a slowdown in profits. In 2021, KTDA published a report indicating that more than 70% of tea farmers were receiving lower prices for their produce compared to

previous years, undermining the financial sustainability of processing companies reliant on these farmers (Jama & Ndung'u, 2024).

The erosion of market share for tea processing companies in Kiambu County has been exacerbated by both domestic and international competition. While Kenya remains one of the largest tea exporters globally, its market share in global exports has declined in recent years. Kenya's share of global tea exports fell from 23.5% in 2020 to 22% in 2021, according to the Kenya National Bureau of Statistics (Muricho & Muli, 2021). This decline is partly due to the rising competition from emerging tea-producing countries like India and Sri Lanka, which have increased their production capacity and improved their quality standards. Furthermore, Kenya's reliance on a few key markets, including the United Kingdom and Pakistan, has made the industry vulnerable to geopolitical shifts and changing demand patterns (Ndubi & Ndeto, 2024). In 2021, the UK reduced its imports of Kenyan tea by 12%, while demand from Pakistan also dropped by 6%, directly affecting the market share of Kenyan tea. Domestically, there has been a shift in consumer preferences toward alternative beverages like coffee, herbal teas, and energy drinks. Data from the Kenya Bureau of Statistics shows that in 2022, the consumption of coffee in Kenya increased by 4%, while tea consumption grew by only 1%, signaling a potential loss of market share for tea in the local beverage market (Mairura & Muturi, 2022).

Customer satisfaction is another area where tea processing companies in Kiambu face substantial challenges. Product quality and consistency remain critical issues, with adverse weather conditions, pests, and diseases affecting the quality of tea leaves. In 2020, the Kenya Plant Health Inspectorate Service (KEPHIS) reported that 10-15% of Kenyan tea exports were rejected due to quality issues such as contamination, improper packaging, and excessive moisture levels (Kariuki, Ngugi & Odhiambo, 2023). This not only damages the reputation of Kenyan tea globally but also leads to financial losses for tea processors. Additionally, delivery delays, both locally and internationally, have contributed to customer dissatisfaction. According to the Kenya Tea Growers Association (KTGA), over 25% of tea processors in Kiambu have reported delays in fulfilling export orders, largely due to inefficient transportation networks, inadequate storage facilities, and the lack of reliable supply chain infrastructure (Jama & Ndung'u, 2024). These delays have led to dissatisfaction among both domestic consumers, who experience inconsistent availability, and international buyers who face delays in receiving products. For example, in 2021, a report from KTGA indicated that tea processing companies lost nearly Ksh 500 million due to supply chain delays and rejected shipments, which severely impacted their relationships with buyers and led to a decline in customer loyalty (Muricho & Muli, 2021).

The adoption of supply chain resilience strategies is essential for improving the performance of tea processing companies. Resilience strategies can significantly mitigate the impact of external disruptions (Jama & Ndung'u, 2024). Various studies have been conducted in different parts of the world on supply chain resilience strategies and organization performance. For instance, Ndubi and Ndeto (2024) assessed on supply chain resilience strategies and performance of supermarket chains. Mairura and Muturi (2022) examined on the effect of supply chain resilience strategies on operational performance of manufacturing firms and Kariuki, Ngugi and Odhiambo (2023) conducted a study on the influence of supply chain resilience on performance of categorized hospitals. However, none of these studies focused on risk mapping, and technology integration on performance of tea processing companies in Kiambu County, Kenya. To fill the highlighted gaps, the current study sought to determine the effect of supply chain resilience strategies (risk mapping, and technology integration) on performance of tea processing companies in Kiambu County, Kenya.

Objective of the Study

The general objective of the study is to determine the effect of supply chain resilience strategies on performance of tea processing companies in Kiambu County, Kenya

The study was guided by the following specific objectives;

i. To establish the effect of risk mapping on performance of tea processing companies in Kiambu County, Kenya.
ii. To find out the effect of technology integration on performance of tea processing companies in Kiambu County, Kenya.

LITERATURE REVIEW

Theoretical Framework

Contingency Theory

Contingency Theory, developed by Fred E. Fiedler in the 1960s often associated with leadership and organizational management, proposes that there is no one-size-fits-all approach to leadership or management practices. Instead, the effectiveness of leadership styles, organizational structures, and management strategies depends on the specific context in which they are applied. This theory suggests that different situations require different kinds of leadership and management approaches for optimal performance (Masrina *et al*, 2020). At its core, Contingency Theory asserts that various factors in the external environment and within the organization itself interact to determine the most effective leadership style or management practice. These factors can include the organization's size, its industry or sector, the complexity of its tasks, its culture, the skills and personalities of its employees, and the external environment such as market conditions or regulatory requirements (Sangwa & Dushimimana, 2023).

One of the key principles of Contingency Theory is the idea of fit or match between the leader's or manager's style and the situational demands. For example, in a highly uncertain and rapidly changing environment, a more flexible and adaptive leadership style may be more effective than a rigid, authoritarian approach (Wawire, Fozia & Kiganda, 2020). Similarly, in organizations with complex tasks that require specialized knowledge and expertise, leaders who can facilitate collaboration and empower their teams may be more successful than those who rely solely on hierarchical authority. Contingency Theory also emphasizes the importance of understanding the unique characteristics of each situation and tailoring leadership and management practices accordingly (Otieno & Mutiso, 2021). This flexibility allows leaders and managers to adjust their strategies based on the specific challenges and opportunities they face, thereby enhancing organizational effectiveness and performance. Critically, Contingency Theory challenges the notion of a universally "best" or "ideal" leadership style. Instead, it encourages leaders and managers to be adaptive and responsive, continuously evaluating and adjusting their approach to align with the evolving needs of the organization and its environment. By considering the contingency factors and adapting their practices accordingly, leaders can optimize their effectiveness and contribute to the overall success of their organizations (Mutai, 2024).

One fundamental assumption is that there is no one-size-fits-all approach to leadership or management effectiveness. This implies that the effectiveness of leadership styles and organizational practices varies depending on the specific context, including factors such as the organization's size, industry, task complexity, and external environment (Masrina *et al*, 2020). However, critics argue that this assumption may oversimplify the complexities of leadership

and organizational dynamics by neglecting the potential for hybrid or blended approaches that integrate multiple leadership styles to address diverse organizational needs. Another assumption of Contingency Theory is the concept of fit or match between leadership styles and situational demands. It posits that the effectiveness of a leader depends on how well their style aligns with the requirements of the situation (Sangwa & Dushimimana, 2023). This assumption suggests that leaders should adapt their behaviors and strategies based on the circumstances they face, whether it involves adopting a more participative approach in collaborative settings or a more directive approach in crisis situations. However, critiques argue that while fit is important, the theory may not sufficiently address the dynamic and fluid nature of organizational environments, where situational demands can change rapidly and require ongoing adjustments in leadership approaches (Wawire, Fozia & Kiganda, 2020).

Critics also question the theory's emphasis on identifying specific contingency factors that determine leadership effectiveness. While Contingency Theory acknowledges the relevance of factors such as task structure, organizational culture, and external pressures, critics argue that these factors are often interrelated and complex, making it challenging to isolate their individual impacts on leadership outcomes (Otieno & Mutiso, 2021). This limitation suggests that a more nuanced understanding of the interactions between various contingency factors is needed to effectively apply the theory in practice and tailor leadership interventions accordingly. Furthermore, Contingency Theory has been criticized for its prescriptive nature, as it often implies that leaders should adopt a specific style or approach based on the situation's characteristics (Mutai, 2024). Critics argue that this prescriptiveness may overlook the importance of leader flexibility, adaptability, and creativity in responding to unexpected challenges and opportunities. They advocate for a more dynamic and responsive approach to leadership that integrates contingency considerations with principles of agility, resilience, and innovation (Masrina *et al*, 2020). This theory was used to establish the effect of risk mapping on performance of tea processing companies in Kiambu County, Kenya.

Diffusion of Innovations Theory

Innovation Diffusion Theory (IDT) is a framework that seeks to explain how new ideas, practices, and technologies spread within and between social systems. Developed by Rogers (1962), the theory emphasizes the process by which innovations are communicated over time among the members of a social group (Olaoye, Olaofe-Obasesin & Akanni, 2021). At its core, IDT identifies several key elements that influence the adoption of innovations, including the characteristics of the innovation itself, the communication channels used to disseminate information, the social system in which the innovation is introduced, and the individual adopter's characteristics (Uwamahoro, Shale & Wachiuri, 2023). One of the central components of IDT is the attributes of innovations, which are factors that determine how likely an innovation is to be adopted. Rogers identified five key attributes: relative advantage (the perceived benefits of the innovation compared to existing solutions), compatibility (how well the innovation aligns with existing values and practices), complexity (the perceived difficulty of using the innovation), trialability (the ease with which the innovation can be tested), and observability (the visibility of the innovation's results to others). These attributes play a critical role in shaping perceptions and, consequently, the rate of adoption among potential users (Mbugua & Namada, 2020).

Another significant aspect of IDT is the adoption process, which occurs in several stages: knowledge, persuasion, decision, implementation, and confirmation. During the knowledge stage, potential adopters become aware of the innovation. In the persuasion stage, they form opinions about the innovation, which can lead to a decision to adopt or reject it (Omanyo,

2022). Implementation involves putting the innovation into practice, and confirmation is the stage where adopters seek reinforcement of their decision, either strengthening their commitment or leading to discontinuance if the innovation does not meet expectations. IDT also emphasizes the importance of social networks and communication channels in the diffusion process. Innovations are often spread through interpersonal communication among peers, opinion leaders, and early adopters who influence others within their social networks. This social aspect highlights that the diffusion of innovations is not merely a linear process but rather a complex interplay of individual choices and social dynamics (Kibor & Tumuti, 2020).

Innovation Diffusion Theory (IDT) is built on several foundational assumptions that shape its framework and application. One key assumption is that the adoption of innovations is a rational process, where individuals assess the attributes of the innovation and make decisions based on perceived benefits and risks (Olaoye, Olaofe-Obasesin & Akanni, 2021). This rationality implies that the characteristics of the innovation—such as its relative advantage, compatibility, and complexity—play a critical role in determining its rate of adoption. Additionally, IDT assumes that the diffusion process occurs over time and follows a predictable pattern, where early adopters pave the way for later adopters. This view suggests that understanding the stages of the adoption process can help facilitate broader acceptance of innovations (Uwamahoro, Shale & Wachiuri, 2023).

Despite its strengths, IDT has faced several critiques that highlight its limitations. One significant criticism is that it can oversimplify the complexities of the adoption process. Critics argue that the model does not fully account for the influence of emotions, cultural factors, and social contexts on individuals' decisions to adopt innovations (Mbugua & Namada, 2020). This oversight can lead to a narrow understanding of why some innovations succeed while others fail, particularly in diverse or rapidly changing environments where social dynamics play a crucial role. Another critique centers on the assumption that all innovations follow a linear diffusion process. In reality, the diffusion of innovations can be nonlinear and influenced by various external factors, such as market conditions, regulatory environments, and competitive dynamics (Omanyo, 2022). This variability challenges the theory's applicability across different contexts and suggests that the stages of adoption may not be universally relevant. For instance, innovations that disrupt existing markets might experience rapid adoption cycles, defying the traditional model's predictions (Kibor & Tumuti, 2020). This theory was used to find out the effect of technology integration on performance of tea processing companies in Kiambu County, Kenya.

Conceptual Framework

A conceptual framework is an assumed model that aids in the identification of study concepts as well as their interactions with one another (Mugenda & Mugenda, 2019). The diagram below shows the relationship between the independent variables (risk mapping, and technology integration) while the independent variable is performance of tea processing companies in Kiambu County, Kenya

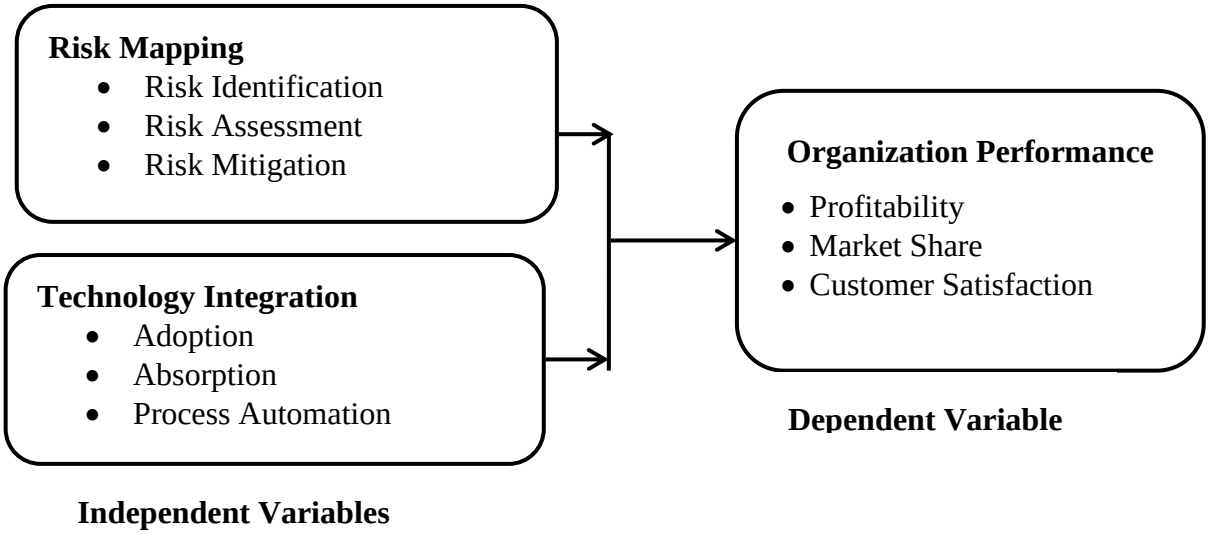

Figure 2. 1: Conceptual Framework

Risk Mapping

Risk mapping is a process used to identify, assess, and visualize potential risks within a business or operational context, typically through a graphical representation (Masrina *et al*, 2020). It involves categorizing risks based on their likelihood of occurrence and the potential impact on the organization, often placing them on a risk matrix or map. This helps businesses prioritize which risks need immediate attention and resources, allowing for more effective risk management (Sangwa & Dushimimana, 2023). Risk mapping is particularly valuable in complex environments like supply chains or project management, as it enables organizations to visualize vulnerabilities, make informed decisions, and develop proactive strategies to mitigate or manage identified risks. It serves as a crucial tool for improving overall risk preparedness and resilience (Wawire, Fozia & Kiganda, 2020).

Risk identification is the first step in the risk management process, where organizations systematically identify potential risks that could impact their objectives, projects, or operations (Otieno & Mutiso, 2021). This involves analyzing various internal and external factors that could pose threats, such as economic shifts, supply chain disruptions, technological failures, legal challenges, or natural disasters. Risk identification typically involves brainstorming sessions, interviews with stakeholders, historical data analysis, and scenario planning (Mutai, 2024). The goal is to create a comprehensive list of possible risks that could affect the organization, ensuring that no significant risk is overlooked. Effective risk identification helps an organization be proactive in addressing vulnerabilities before they materialize into actual problems (Masrina *et al*, 2020).

Risk assessment follows risk identification and involves evaluating the likelihood and potential impact of each identified risk (Sangwa & Dushimimana, 2023). This process often includes scoring or ranking risks based on their probability of occurrence and the severity of their consequences. The purpose of risk assessment is to prioritize risks according to their potential harm to the organization, allowing resources and efforts to be focused on managing the most critical risks first (Wawire, Fozia & Kiganda, 2020). Organizations typically use tools like risk matrices or quantitative methods to assess risks, considering factors such as financial loss, operational disruption, reputational damage, and legal or regulatory consequences. A well-

conducted risk assessment ensures that the organization is prepared to address the risks that pose the greatest threat (Otieno & Mutiso, 2021).

Risk mitigation is the process of developing and implementing strategies to reduce or eliminate the potential impact of identified risks (Mutai, 2024). Once risks have been assessed and prioritized, organizations create action plans to either prevent the risk from occurring, minimize its effects, or transfer the risk to another party (such as through insurance or outsourcing). Mitigation strategies can include changes in processes, investments in new technology, diversifying suppliers, enhancing security measures, or creating contingency plans (Masrina *et al*, 2020). Effective risk mitigation not only reduces the likelihood of negative outcomes but also prepares the organization to respond swiftly if a risk does materialize. The ultimate aim of risk mitigation is to ensure business continuity, minimize disruption, and safeguard the organization's assets and reputation (Sangwa & Dushimimana, 2023).

Technology Integration

Technology integration refers to the process of incorporating various technological systems, tools, and software into an organization's existing operations to improve efficiency, streamline workflows, and enhance overall performance (Olaoye, Olaofe-Obasesin & Akanni, 2021). In the context of supply chain management, technology integration involves connecting systems like Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supplier Relationship Management (SRM) platforms with suppliers and other partners. This seamless integration allows for real-time data sharing, improved communication, automated processes, and better decision-making (Uwamahoro, Shale & Wachiuri, 2023). By leveraging technology, organizations can gain deeper insights into their supply chains, track inventory more accurately, reduce errors, and enhance responsiveness to changes in demand or supply conditions. Technology integration not only boosts operational efficiency but also supports innovation and competitive advantage in a rapidly evolving business environment (Mbugua & Namada, 2020).

Adoption refers to the initial stage of incorporating new technologies, tools, or systems into an organization's operations (Omanyo, 2022). In the context of supply chain management, adoption involves choosing and integrating new technologies that can enhance efficiency, communication, and data visibility within the supply chain. This stage typically requires training staff, ensuring compatibility with existing systems, and establishing processes for successful implementation (Kibor & Tumuti, 2020). The adoption phase is crucial because it sets the foundation for the technology's impact on the organization, requiring buy-in from key stakeholders and alignment with overall business objectives. Successful adoption ensures that the organization is prepared to maximize the benefits of new technological solutions, driving productivity and improving decision-making (Olaoye, Olaofe-Obasesin & Akanni, 2021).

Absorption refers to the process by which an organization fully internalizes and integrates new technologies into its day-to-day operations (Uwamahoro, Shale & Wachiuri, 2023). It is not only about implementing the technology but also about adapting the organizational culture, workflows, and employee skills to fully leverage the capabilities of the new system. In supply chain management, absorption involves using the newly adopted technology to automate tasks, analyze data, and improve decision-making, while continuously refining processes for greater efficiency (Mbugua & Namada, 2020). Successful absorption ensures that the technology becomes a natural part of the organization's operations, contributing to sustained improvements in performance. This phase can involve ongoing training, feedback loops, and

continuous adaptation to ensure the full benefits of the technology are realized (Omanyo, 2022).

Process automation refers to the use of technology to automate repetitive, manual tasks within business operations, thereby increasing efficiency, reducing errors, and freeing up resources for more strategic activities (Kibor & Tumuti, 2020). In supply chain management, process automation can involve automating tasks such as order processing, inventory management, procurement, and scheduling. By replacing manual processes with automated systems, organizations can improve accuracy, speed up decision-making, and reduce labor costs (Olaoye, Olaofe-Obasesin & Akanni, 2021). Automation also enhances scalability, allowing businesses to handle higher volumes of transactions without proportionally increasing overhead. Ultimately, process automation not only streamlines operations but also contributes to the overall agility of the supply chain, enabling organizations to respond more quickly to market changes and customer demands (Uwamahoro, Shale & Wachiuri, 2023).

Empirical Review

Risk Mapping and Organization Performance

Masrina *et al* (2020) assessed on investigating the impact of effective risk mapping on the performance of Malaysian publicly listed companies. This research explores the intricate relationship between effective risk management and the performance of publicly listed companies in Malaysia. As a quantitative investigation, it involves a robust dataset of 1,216 year-observations spanning four years, from 2018 to 2021, with a specific focus on publicly listed entities. The findings indicate that all key risks, representing effective risk mapping, significantly influence the firm performance of Malaysian publicly listed companies. The study concluded that risk mapping has significant and positive influence on the performance of Malaysian publicly listed companies.

Sangwa and Dushimimana (2023) assessed the effect of risk mapping practices on project performance. A Case of Twiceceka Project/WFWI-Huye District, Rwanda. The researcher used a census survey. The sample size was 200 respondents, all targeted populations included. Questionnaires were used to collect the primary data for this study. Secondary data were also used to conduct the study. The questionnaires are comprised of both open-ended and closed-ended questions. The questionnaires were piloted first to determine instrument reliability before distribution. The questionnaires were administered through the drop and pick later method. The study found that risk mapping practices have a significant positive effect on the performance of the Twiceceka Project in Huye District. The results concluded that a higher level of attention to risk mapping is associated with improved project outcomes.

Wawire, Fozia and Kiganda (2020) examined risk mapping practices and supply chain performance in county governments of Western Kenya: Applications of risk identification. The study used a descriptive research design. The target population was 150 employees comprising procurement officers, logistics managers, and directors of audit service, quality assurance, and finance officers from Vihiga, Kakamega, Bungoma and Busia Counties. The study used a census sample strategy, focusing on all 150 employees. Primary data were gathered for the study utilizing closed-ended questionnaires. The study showed that risk mapping, had a significant positive influence on supply chain performance. The study concluded that risk identification had a significant positive association with supply chain performance.

Otieno and Mutiso (2021) researched on the influence of project risk mapping on performance of agricultural projects in Nakuru County; Kenya. Descriptive research design was used to guide this study. The sample size composed of 116 agricultural projects drawn from the 11 sub-counties in Nakuru County. Respondents from each stratum were picked on a random basis using the simple random method in order to eliminate bias as the method gives each member a fair chance of selection. The study established that most of the project risk mapping has positive impact on performance of the agricultural projects. The study revealed that risk mapping n has a significant influence on performance of agricultural projects. The study concluded that risk mapping has a positive influence on performance of agricultural projects.

Mutai (2024) assessed the effect of risk mapping strategies on the organizational performance of oil companies in Kenya. The research adopted descriptive correlation. The study population was oil companies in Nairobi County. According to Energy & Petroleum Statistics Report (2020) there are 71 registered oil companies in Nairobi County. The target population comprised one operational manager, one finance manager, one director and one risk manager from the 71 companies which totaled to 284 respondents. The findings revealed a high positive relationship between risk mapping and organizational performance. The research also revealed that there is a high level of correlation between risk mapping strategies and organizational performance. The study concluded that effective mapping of risk is essential for any enterprise since it positively affects organizational performance.

Technology Integration and Organization Performance

Olaoye, Olaofe-Obasesin and Akanni (2021) examined on the impact of technology integration on corporate organizations performance in Nigeria. The study is empirical as questionnaire was the primary source of data while results were presented on average, variance and standard deviation. The target respondents constitute specialist in the field of information technology, specifically Lagos state. The study found that technology integration has a significant impact on corporate organizations performance in Nigeria. The study concluded that technology integration has a significant impact on corporate organizations performance in Nigeria.

Uwamahoro, Shale and Wachiuri (2023) assessed on technology integration and performance of manufacturing firms in Rwanda. The study adopted explanatory research design. The study found that technology integration contributes positively towards performance of manufacturing firms in Rwanda. The study concluded that technology integration was positive and significant.

Mbugua and Namada (2020) researched on technology integration effect on operational performance of Kenya's public health sector. The study used a causal, non-experimental, and cross-sectional research design. Regression analysis was carried out based on data from 164 respondents. The study found that technology integration has a significant effect on operational performance. The study concluded that technology integration leads to the improved operational performance of the health facilities.

Omanyo (2022) conducted a study on the relationship between technology integration and operational performance of hotels in Kenya. The study used a descriptive cross-sectional survey design. The population of the study comprised of all hotels in Kenya. The study found that there is a strong positive correlation between technology integration and operational performance of hotels in Kenya. The study concluded that there is a positive relationship between technology integration and operational performance.

Kibor and Tumuti (2020) investigated on technology integration and performance of tertiary institutions in Nairobi County, Kenya. The study employed a descriptive cross-sectional survey design. A simple random sampling approach was used to obtain a sample of 60 respondents for the study. The study found that technology integration resulted in better performance of tertiary institutions. The study concluded that technology integration affect the performance of tertiary institutions positively.

RESEARCH METHODOLOGY

This study used descriptive research design which involved gathering of data that describes events then organizing, tabulating depicting and describing the data. The choice of this research design was influenced by the fact that it enables the researcher to assess the situation in the study area at the time of study. This study targeted tea processing companies in Kiambu County. Currently there are 66 operational tea factories under the KTDA (MS) Ltd management, each managed by a board of directors elected by and from among the growers of the specific factory catchment (KTDA, 2024). This study therefore targeted the management employees in these companies. In every company, the study targeted 1 top manager, 3 middle level managers and 5 lower level managers. The total target population was therefore 594 respondents.The sampling frame for this study was the list of management level employees at telecommunication companies in Kenya. It is from this list that the study sample was selected from.The study used Krejcie and Morgan (1970) formula to arrive at the sample size. The study sample size was 170 employees. Stratified random sampling was applied to get the respondents. The study then used simple random sampling to select respondents from each stratum. In simple random sampling, every respondent had an equal chance of participating in the study.

Table 1: Sample Size

Category	Target Population	Sample Size
Senior level management	66	19
Middle Level Management	198	57
Low Level Management	330	94
Total	**594**	**170**

This research used a questionnaire to collect primary data. According to Patton *et. al* 2016, a questionnaire is appropriate in gathering data and measuring it against a particular point of view. Quantitative data was coded then analyzed using Statistical Package for Social Sciences (SPSS) computer software version 28. Descriptive statistics was used to analyze the data in frequency distributions and percentages which were presented in tables and figures. Discussions and presentations of the analyzed data were done in tables of frequency distribution, percentages, bar graphs and pie charts. Measures of dispersion were used to provide information about the spread of the scores in the distribution. The study also adopted multiple regression analysis to test the relationships between the variables.

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

The researcher sampled 170 respondents who were each administered with the questionnaires. From the 170 questionnaires 148 were completely filled and returned hence a response rate of 87.1%. The response rate was considered as suitable for making inferences from the data collected. As indicated by Metsamuuronen (2017), a response rate that is above fifty percent is considered adequate for data analysis and reporting while a response rate that is above 70% is classified as excellent. Hence, the response rate of this study was within the acceptable limits for drawing conclusions and making recommendations.

Descriptive Statistics Analysis

Risk Mapping and Organization Performance

The first specific objective of the study was to establish the effect of risk mapping on performance of tea processing companies in Kiambu County, Kenya. The respondents were requested to indicate their level of agreement on various statements relating to risk mapping and performance of tea processing companies in Kiambu County, Kenya. The results were as shown in Table 2. From the results, the respondents agreed that their organization regularly identifies and maps potential risks in their operations (M=3.789, SD= 0.923). In addition, the respondents agreed that they have a clear process for assessing and prioritizing risks (M=3.764, SD=0.718). Further, the respondents agreed that risk mapping is integrated into their overall risk management strategy (M=3.652, SD=0.823). The respondents also agreed that they actively track and monitor identified risks to prevent potential disruptions (M=3.641, SD=0.701). Further, the respondents agreed that they update their risk map regularly to reflect changes in the business environment (M=3.633, SD=0.896). In addition, the respondents agreed that risk mapping helps them prepare proactive strategies to mitigate potential threats (M=3.617, SD=0.572).

Table 2: Risk Mapping and Organization Performance

	Mean	**Std. Deviation**
Our organization regularly identifies and maps potential risks in our operations.	3.789	0.923
We have a clear process for assessing and prioritizing risks.	3.764	0.718
Risk mapping is integrated into our overall risk management strategy.	3.652	0.823
We actively track and monitor identified risks to prevent potential disruptions.	3.641	0.701
We update our risk map regularly to reflect changes in the business environment.	3.633	0.896
Risk mapping helps us prepare proactive strategies to mitigate potential threats.	3.617	0.572
Aggregate	**3.683**	**0.772**

Technology Integration and Organization Performance

The second specific objective of the study was to find out the effect of technology integration on performance of tea processing companies in Kiambu County, Kenya. The respondents were requested to indicate their level of agreement on various statements relating to technology integration and performance of tea processing companies in Kiambu County, Kenya. The results were as presented in Table 3.

From the results, the respondents agreed that their organization actively integrates new technologies to improve operational efficiency (M=3.931, SD= 0.911). In addition, the respondents agreed that they implement advanced technologies to streamline business processes (M=3.909, SD=0.899). Further, the respondents agreed that their company invests in the latest technologies to stay competitive in the market (M=3.887, SD= 0.733). The respondents agreed that they provide adequate training for employees to effectively use integrated technologies (M=3.715, SD=0.864). In addition, the respondents agreed that they

regularly assess and update their technological tools to align with business needs (M=3.641, SD=0.800). Further, the respondents agreed that the integration of technology enhances their ability to deliver high-quality products and services (M=3.628, SD=0.842).

Table 3: Technology Integration and Organization Performance

	Mean	Std. Deviation
Our organization actively integrates new technologies to improve operational efficiency.	3.931	0.911
We implement advanced technologies to streamline business processes.	3.909	0.899
Our company invests in the latest technologies to stay competitive in the market.	3.887	0.733
We provide adequate training for employees to effectively use integrated technologies.	3.715	0.864
We regularly assess and update our technological tools to align with business needs.	3.641	0.800
The integration of technology enhances our ability to deliver high-quality products and services.	3.628	0.842
Aggregate	**3.785**	**0.842**

Organization Performance

The respondents were requested to indicate their level of agreement on various statements relating to performance of tea processing companies in Kiambu County, Kenya. The results were as presented in Table 4.

From the results, the respondents agreed that their organization consistently achieves high profit margins in its operations (M=3.865, SD=0.688). In addition, the respondents agreed that the company's profitability shows significant growth over the last year (M=3.854, SD=0.634). Further, the respondents agreed that their organization holds a significant share of the market compared to their competitors (M=3.788, SD=0.702). The respondents agreed that they successfully increase their market share over the past year (M=3.744, SD=0.731). In addition, the respondents agreed that customers consistently express satisfaction with the quality of their products and services (M=3.698, SD=0.598). Further, the respondents agreed that their organization has a strong reputation for customer service excellence (M=3.671, SD=0.834).

Table 4: Organization Performance

	Mean	Std. Deviation
Our organization consistently achieves high profit margins in its operations.	3.865	0.688
The company's profitability shows significant growth over the last year.	3.854	0.634
Our organization holds a significant share of the market compared to our competitors.	3.788	0.702
We successfully increase our market share over the past year.	3.744	0.731
Customers consistently express satisfaction with the quality of our products and services.	3.698	0.598
Our organization has a strong reputation for customer service excellence.	3.671	0.834
Aggregate	**3.770**	**0.698**

Correlation Analysis

The present study used Pearson correlation analysis to determine the strength of association between independent variables (risk mapping, and technology integration) and the dependent variable (performance of tea processing companies in Kiambu County, Kenya). Pearson correlation coefficient range between zero and one, where by the strength of association increase with increase in the value of the correlation coefficients.

Table 5: Correlation Coefficients

		Organization Performance	Risk Mapping	Technology Integration
Organization Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	148		
Risk Mapping	Pearson Correlation	.873**	1	
	Sig. (2-tailed)	.000		
	N	148	148	
Technology Integration	Pearson Correlation	.838**	.513	1
	Sig. (2-tailed)	.003	.165	
	N	148	148	148

Moreover, the results revealed that there is a very strong relationship between risk mapping and performance of tea processing companies in Kiambu County, Kenya (r = 0.873, p value =0.000). The relationship was significant since the p value 0.000 was less than 0.05 (significant level). The findings conform to the findings of Sangwa and Dushimimana (2023) that there is a very strong relationship between risk mapping and organization performance.

The results also revealed that there was a very strong relationship between technology integration and performance of tea processing companies in Kiambu County, Kenya (r = 0.838, p value =0.003). The relationship was significant since the p value 0.003 was less than 0.05 (significant level). The findings are in line with the results of Omanyo (2022) who revealed that there is a very strong relationship between technology integration and organization performance.

Regression Analysis

Table 6: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	**(Constant)**	0.227	0.061		3.721	0.000
	risk mapping	0.369	0.095	0.370	3.884	0.001
	technology integration	0.382	0.099	0.383	3.859	0.000

a Dependent Variable: performance of tea processing companies in Kiambu County, Kenya

The regression model was as follows:

$$\mathbf{Y = 0.227 + 0.369X_1 + 0.382X_2}$$

The results also revealed that risk mapping has significant effect on performance of tea processing companies in Kiambu County, Kenya, $\beta 1=0.369$, p value= 0.001). The relationship was considered significant since the p value 0.001 was less than the significant level of 0.05. The findings conform to the findings of Sangwa and Dushimimana (2023) that there is a very strong relationship between risk mapping and organization performance

In addition, the results revealed that technology integration has significant effect performance of tea processing companies in Kiambu County, Kenya β1=0.382, p value= 0.000). The relationship was considered significant since the p value 0.000 was less than the significant level of 0.05. The findings are in line with the results of Omanyo (2022) who revealed that there is a very strong relationship between technology integration and organization performance.

Conclusions

In addition, the study concludes that risk mapping has a positive and significant effect on performance of tea processing companies in Kiambu County, Kenya. Findings revealed that risk identification, risk assessment and risk mitigation influences performance of tea processing companies in Kiambu County, Kenya.

The study also concludes that technology integration has a positive and significant effect on performance of tea processing companies in Kiambu County, Kenya. Findings revealed that adoption, absorption and process automation influence performance of tea processing companies in Kiambu County, Kenya.

Recommendations

In addition, the study recommends that the management of tea processing companies in Kenya should implement a comprehensive risk mapping strategy to identify and mitigate potential risks that could impact their performance. By systematically assessing and categorizing risks, companies can proactively develop contingency plans and risk management strategies

The study also recommends that the management of tea processing companies in Kenya should invest in and integrate advanced technology throughout the production process. Adopting modern technologies such as automated processing equipment, data analytics for yield forecasting, and digital platforms for supply chain management can significantly enhance efficiency and productivity.

Suggestions for Further Studies

This study was limited to the effect of supply chain resilience strategies on performance of tea processing companies in Kiambu County, Kenya hence the study findings cannot be generalized to organization performance in other organizations in Kenya. The study therefore suggests further studies on the effect of supply chain resilience strategies on organization performance in other organizations in Kenya.

Further, the study found that the independent variables (risk mapping and technology integration) could only explain 77.8% of performance of tea processing companies in Kiambu County, Kenya. This study therefore suggests further research on other factors affecting performance of tea processing companies in Kiambu County, Kenya.

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