

## HOW DIGITIZATION HAS REVOLUTIONIZED TEA FARMING IN KENYA: A CASE OF KERICHO COUNTY

Phelyster K. NAFULA<sup>1</sup>, Elly NDIAO<sup>2</sup>, Dancea LUCRETIU<sup>3\*</sup>,

<sup>1</sup>Africa International University, Nairobi, Kenya

<sup>2</sup>Africa International University, Nairobi, Kenya

<sup>3</sup>University of Life Sciences "King Michael I of Romania" from Timișoara, Romania

Corresponding author: lucretiu\_dancea@usvt.ro

**Abstract.** *The study sought to examine how digitization has revolutionized tea farming in Kenya with a specific focus on Kericho County in Kenya. The post-modern world, which is largely characterized by digital technology, has brought about the transformation of traditional farming practices such that they are highly digitalized, efficient, and sustainable. The tea industry in Kenya plays a critical role in the nation's agricultural sector since the colonial era. It has significantly contributed to the national economy and provided livelihoods for thousands of small-scale farmers. Also, Kericho county is considered as the heart of tea farming in Kenya, and thus, the region of interest for the study. By focusing on Kericho county, the idea is that the region will function as a model for other regions that produce tea in Kenya and across its borders, with the focus on valuable lessons for leveraging technology to enhance agricultural practices. The study employed a desktop review and used the online libraries of Africa International University and University of Timisoara. This methodology enabled the researchers to examine the impact of digital technology on tea farming in Kenya, with a specific focus on Kericho County. By reviewing a wide range of scholarly articles, the research assessed the extent of the integration of digital technology in tea farming in the county in terms of its influence on productivity, and the challenges experienced by farmers. Key findings of the review included the prevalent use of technologies associated with mechanical harvesting, planting and cutting strategies including mobile applications resulting in improved yield production, access to markets, and decreased post-harvest losses. The findings also addressed the challenges faced by farmers such as access to technology, digital literacy, data security concerns including unemployment among the youth. The conclusion is that there is need for government policies that ensure that the welfare of farmers in the region is protected despite the mechanization of various processes and that farmers are informed on how they can take advantage of digital technology in their daily farming practices.*

**Keywords:** *Digitization, Digital Technology, Tea Industry, Mechanization, Productivity*

### INTRODUCTION

History posits that tea farming in Kenya began during the colonial era when the first seedlings were brought by the colonialists in 1903. The goal was to experiment with whether they would grow in highland areas such as Limuru and Kericho (Saeteurn, 2022). A significant aspect to consider is that the commercial production of tea was initialized in 1924 and was maintained as the main preoccupation of the white settlers for 32 years until the Africans started tea farming (Saeteurn, 2022). Currently, tea farming occurs in the highlands, primarily the east and west parts of the Rift Valley. The highlands cover various counties in Kenya that are actively involved in tea farming, counties that include Kericho, Nakuru, Kiambu, Vihiga, Nandi, Narok, Bomet, Trans-Nzoia, Nyeri, Elgeyo Marakwet, Embu, Kirinyaga, Bungoma, Tharaka-Nithi, Nyamira, Meru, Murang'a, Kakamega, and Kisii. Tea, in this case, is grown at an altitude of between 1500m and 2700m (Muoki et al., 2020). The production of tea in Kenya is year-round, an aspect that is attributed to the minimal variation in seasons and its geographical placement along the equator. The idea is that the highlands are characterized by favorable weather conditions that sustain tea farming (Muoki et al., 2020).

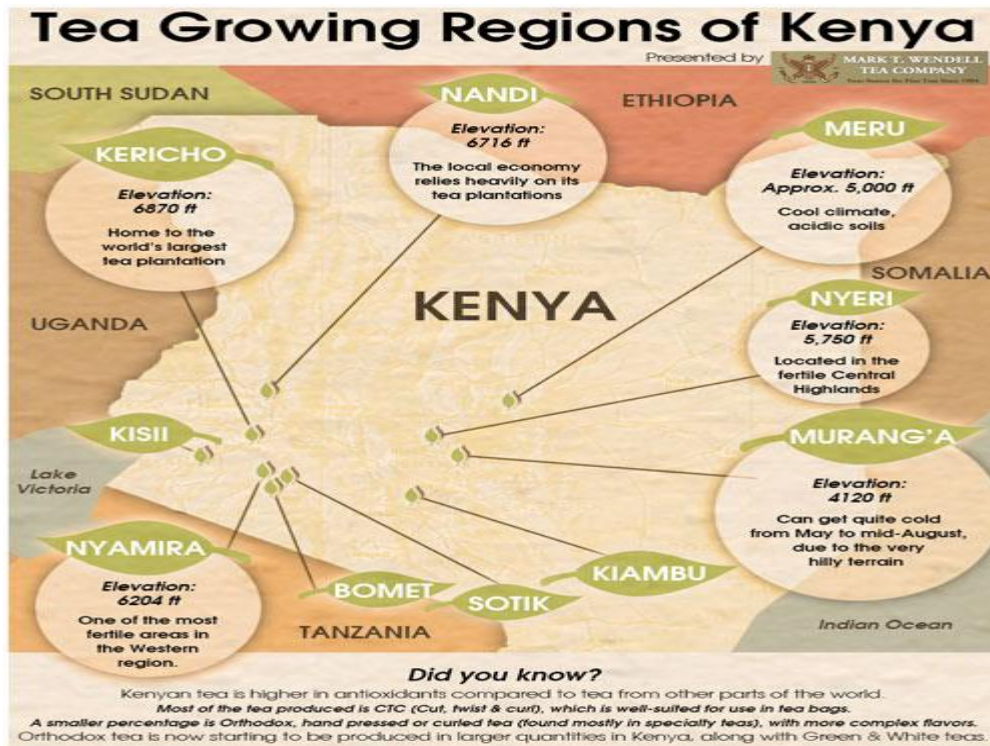


Fig.1 Tea growing regions in Kenya (Karlsson, 2022)

From a socio-economic perspective, the tea industry in Kenya functions as the largest earner of foreign exchange. It is estimated that on an annual basis, the nation produces more than 450 million kilograms of tea, providing the country with more than Kshs.22 billion in sales done locally and Kshs.120 billion in export earnings (Karlsson, 2022). Also, about 650,000 individuals are functioning as tea growers who rely on tea production as their main source of livelihood (Karlsson, 2022). The Kenya tea industry is popular across the globe because it adheres to safety and quality standards in agricultural practices particularly not using agro-chemicals or pesticides. This entails the integration of proper husbandry practices, high-quality varieties, and skillful processing strategies such as not using additives or artificial coloring. Furthermore, it complies with the requirements of the social market and environmental regulations and experiences constant improvement due to the integration of modern technology in its processes. The latter puts into perspective the role of technology in tea farming in Kenya (Karlsson, 2022). Thus, the study sought to examine how digitization has revolutionized tea farming in Kenya with a specific focus on Kericho County in Kenya.

Kericho County is among the counties located within the Rift Valley, receives adequate rainfall and is characterized by fertile soils and a cool climate. Thus, agriculture functions as the main source of income and livelihood for more than 50% of the residents (Aoko & Mose, 2022). It is estimated that 79% of the land is arable and most people live in the rural areas that include Buret, Chepseon, Londiani, Soin, and Cheborge, areas where tea farming flourishes (Aoko & Mose, 2022). The region contains four agro-ecological zones that include lower midlands, upper midlands, lower highlands, and upper highlands whereby the crops commonly grown in them include tea, maize, beans, and coffee. Dairy farming is also

actively practiced in the region alongside the growing of flowers, wheat, pineapples, and potatoes. Tea farming supports more than 5 million individuals in Kenya county and the county produces 46% of the total tea produced in Kenya (Aoko & Mose, 2022). This implies that tea functions as a significant part of the county’s economy.

**Statement of the Research**

The post-modern world, which is largely characterized by digital technology, has brought about the transformation of traditional farming practices such that they are highly digitalized, efficient, and sustainable. The tea industry in Kenya has played a critical role in the nation’s agricultural sector since the colonial era. It has significantly contributed to the national economy and provided livelihoods for thousands of small-scale farmers. Also, Kericho county is considered the heart of tea farming in Kenya, and thus, the region of interest for the study. By focusing on Kericho County, the idea is that the region will function as a model for other regions that produce tea in Kenya and across its borders, with a focus on valuable lessons for leveraging technology to enhance agricultural practices.

**Research Question**

What is the impact of digital technology on tea farming in Kericho County, Kenya?

**Research Objectives**

1. To identify the digital technologies and practices that have been adopted in tea farming within Kericho County, Kenya
2. To identify the benefits for tea farmers and the tea industry in Kericho County, Kenya.
3. To identify the challenges for tea farmers and the tea industry in Kericho County, Kenya.

**MATERIAL AND METHODS**

A desk review was used to examine the impact of digital technology on tea farming in Kericho County, Kenya. This involved accessing articles from various databases and recent reports that offer insight into the research topic. It is an efficient approach to gathering data when time and resources are limited (Froese & Bader, 2019). The articles were obtained from AIU and ULST databases in which the study was limited to research done between 2018 and 2023. The search terms included “Digitization”, “Digital Technology”, “Tea Industry”, and “Mechanization.” The data analysis entailed examining the main findings from the studies. The information was then divided in terms of the digital technologies and practices that have been adopted in tea farming, the benefits for tea farmers and the tea industry in Kericho County, and the challenges for tea farmers and the tea industry in Kericho County.

*Table 1.*

A list of the articles used in the review

Articles	Key Points
Kilel (2019) Kirui et al. (2020)	Mechanical harvesting in tea farming
Kilimo News (2023) Simon and Tare (2020) Rorogu and Bett (2018) Aoko and Mose (2022)	Mobile applications in tea farming
Ekwang (2021) Chepkemoi et al. (2023)	Benefits of digital technology for tea farmers in Kericho County

Terer and Kipkorir (2019)	Challenges of digital technology for tea farmers in Kericho County
Kirui (2020)	
Chepkemoi et al. (2023)	
Mulwa (2022)	
Momanyi et al. (2020)	

## RESULTS AND DISCUSSIONS

### *Digital technologies and practices that have been adopted in tea farming*

#### I. Mechanical harvesting

A significant aspect to note is that tea harvesting entails removing the growing shoots from the upper section of the tea bush (Kilel, 2019). It involves two processes that include coarse picking and fine picking. Fine plucking involves picking the bud, second and third leaves while coarse picking entails picking more leaves together with the bud (Kilel, 2019). Before the introduction of mechanical harvesting, tea harvesting was done by hand in Kenya and other tea-producing nations such as Papua New Guinea, China, Japan, and India (Kirui et al., 2020). According to Kirui et al. (2020), some of the technologies used for mechanical tea harvesting in Kenya include tea harvesters, tractors towed harvesters, and pruning machines. The tea harvester functions as a specialized machine that is equipped with rotating blades used for cutting the leaves. Through the involved mechanical aspects, the harvesters navigate across the tea plantations and efficiently harvest the leaves. As per the study by Simon and Tare (2020), tractors that are equipped with towing devices can be used to pull mechanical tea harvesters through the fields. This makes the harvesting process more efficient especially since the towed harvesters are attached to tractors and operated by a specialized driver. Furthermore, the pruning machines trim the bushes to maintain their shape and facilitate new growth which assists with maintaining the productivity of the trees. Some of the implications include increased efficiency, labor reduction, and consistency in quality. On increased efficiency, mechanical harvesting has led to improved efficiency of tea harvesting as it has enabled a rapid collection of the leaves and a reduction in the labor and time spent in manual picking (Simon & Tare, 2020) leading to improved productivity and savings of costs for the farmers. However, cost constraints to maintain the equipment, especially for the small-scale farmers, environmental implications and a reduction in employment opportunities function as significant challenges associated with the mechanization of harvesting.

#### II. Mobile Applications

Mobile technology has become popular in the contemporary world where people want to remain connected with others and access diverse information on issues of their interest. It is estimated that in Kenya, at least 30 million of the population own mobile phones, an aspect that suggests that most adults have phones (reference?). Mobile applications have recently been integrated into the tea farming industry particularly the Unstructured Supplementary Service Data (USSD) and the Short Messaging Service (SMS) to improve engagement and communication among the tea farmers (Kilimo News, 2023). This was a recent move by the Kenya Tea Development Agency (KTDA) as a way of ascertaining transparency between the farmers and the organization whereby they can access the statuses of their accounts at any given time using their mobile phones. This implies that farmers are regularly updated on the weights of their plucked weight, payments, extension services, and updates including being able to make queries on the disbursement of fertilizers. A significant aspect to note is that the relevant apps can easily be accessed on the Google Play Store. Another innovation is the farmer training application used by the farmers in the county to acquire training to adjust or improve their practices. It functions as a good example of how digital technology is being used

in the tea industry to enhance agricultural knowledge among the farmers, to link farmers with peer-sharing networks including to facilitate and support sustainable farming methods. Farmers in the county are also actively using DigiFarm, a mobile application that was developed by Safaricom, a leading mobile service provider in Kenya. DigiFarm is a cost-free service provided by Safaricom, designed to provide farmers with a comprehensive solution for easy access to discounted high-quality agricultural inputs, input loans, educational resources on farming, and the opportunity to connect with markets. DigiFarm also offers additional services like insurance coverage for crop yields and access to agricultural advice through remote agronomists available at the DigiFarm call center or local DigiFarm Village Advisors (DVA). As per the study by Rorogu and Bett (2018), mobile phones enhance the efficiency of processing companies as they ascertain quick communication through SMS or calling including the use of applications such as WhatsApp. Nonetheless, a challenge arises when the staff decides to use the applications for their personal ends instead of company operations. The authors state, “The processing companies should invest more in computers as they were found to have a direct relationship with the profitability of the firm as well as database management” (Rorogu & Bett, 2018, p.31). As per the research by Aoko and Mose (2022), applications such as mobile banking security and mobile wallets offered by mobile financial service gives positively contribute to the performance of tea cooperatives. This makes the operations of the cooperatives more efficient and contributes to the sustainability of tea farming in the region.

Table 2

Thematic Analysis of the Digital technologies and practices that have been adopted in tea farming

Theme	Key Points	Articles
Mechanical Harvesting	<ul style="list-style-type: none"> <li>- Traditional manual harvesting vs. mechanical harvesting.</li> <li>- Technologies used in mechanical harvesting.</li> <li>- Benefits of mechanical harvesting.</li> <li>- Challenges associated with mechanization.</li> </ul>	Kilel (2019), Kirui et al. (2020) Kirui et al. (2020), Simon & Tare (2020) Simon & Tare (2020) Kilel (2019), Simon & Tare (2020)
Mobile Applications	<ul style="list-style-type: none"> <li>- Integration of mobile apps in tea farming.</li> <li>- Transparency and account management through apps.</li> <li>- Farmer training apps and peer-sharing networks.</li> <li>- DigiFarm and its offerings for farmers.</li> <li>- Role of mobile technology in enhancing efficiency.</li> <li>- Challenges and the need for technology investments.</li> </ul>	Kilimo News (2023) Rorogu & Bett (2018), Aoko and Mose (2022)

***The benefits of digital technology for tea farmers in Kericho County, Kenya***

Digital technology is associated with significant benefits to tea farmers in Kericho County. One of the benefits entails improved data collection and analysis. According to a study by Ekwang (2021), digital tools, particularly tablets and smartphones have allowed tea farmers in the county to gather data more efficiently. This includes data on aspects such as soil quality, plant health, and weather patterns. It is through the data that farmers make better decisions on fertilization, harvesting their tea, and irrigation, an aspect that enables adequate management of crops and improved yields (Ekwang, 2021). Digital technology has also enabled farmers to access information regarding the market through mobile applications and websites, information

such as buyer contacts, and trends in the market including tea prices. This has influenced them to make better decisions on how, where, and when to sell their tea leading to improved income (Chepkemoi et al., 2023). Also, as per the study by Terer and Kipkorir (2019), it was found that that online training platforms have enabled tea farmers in Kericho County to access information on adequate farming practices including pest management and sustainable farming methods (Terer & Kipkorir, 2019). The basic view is that the use of digital practices in the county has led to improved efficiency, increased sustainability, and enhanced productivity. It has also empowered them to make better decisions in managing their farms and dealing with changes in the market. Aoko and Mose (2022) emphasize the need for extensive digitalization of tea farming in Kericho County to maximize the profits for both farmers, the involved cooperatives and organizations, and other stakeholders. This is attributed to how the mobile financial service providers positively contribute to the performance of tea cooperatives. This also includes using mobile services to make and receive payments including checking their account balances (Chepkemoi et al., 2023). It implies that the investment in the digitization of the industry is beneficial in relation to the management of the industry by the key stakeholders. Nonetheless, there are significant challenges that farmers have experienced in relation to the use of digital technologies.

Table 3

Thematic Analysis of the benefits of digital technology for tea farmers in Kericho County, Kenya

Themes	Key Benefits	Articles
Improved Data Collection and Analysis	<ul style="list-style-type: none"> <li>- Use of tablets and smartphones for efficient data gathering.</li> <li>- Data on soil quality, plant health, and weather patterns.</li> <li>- Informed decisions on fertilization, harvesting, and irrigation.</li> <li>- Enhanced crop management and improved yields.</li> </ul>	Ekwang (2021)
Market Information Access	<ul style="list-style-type: none"> <li>- Access to market information through mobile apps and websites.</li> <li>- Buyer contacts and market trends, including tea prices.</li> <li>- Informed decisions on when, where, and how to sell tea.</li> </ul>	Chepkemoi et al. (2023)
Online Training Platforms	<ul style="list-style-type: none"> <li>- Access to online training for farming practices.</li> <li>- Knowledge on pest management and sustainable farming methods.</li> </ul>	Terer & Kipkorir (2019)
Improved Efficiency	<ul style="list-style-type: none"> <li>- Enhanced efficiency in tea farming.</li> </ul>	Ekwang (2021), Chepkemoi et al. (2023), Terer & Kipkorir (2019)
Increased Sustainability	<ul style="list-style-type: none"> <li>- Improved sustainability of tea farming.</li> </ul>	Aoko and Mose (2022)
Enhanced Productivity	<ul style="list-style-type: none"> <li>- Empowerment for better decision-making.</li> </ul>	Aoko and Mose (2022)
Digitalization of Tea Farming	<ul style="list-style-type: none"> <li>- Emphasis on extensive digitalization for maximizing profits.</li> <li>- Positive contribution of mobile financial services to cooperatives.</li> <li>- Mobile payment services and account balance checks.</li> </ul>	Aoko and Mose (2022)

***The challenges of digital technology for tea farmers in Kericho County, Kenya***

The research by Kirui (2020) on the viability of mechanical harvesting in tea farms in places such as Kericho, highlights that mechanization, if not adequately managed, can deteriorate the quality of tea. The argument is that tea that is hand-plucked contains high components of biochemical properties when compared to tea that is machine-plucked. The deterioration is associated with non-selective plucking and mechanical injury from mechanical harvesting. Nonetheless, mechanical harvesting is viewed to increase the plucking level and decrease the production cost in comparison to hand plucking. The recommendation for farmers is to engage in the mechanical harvesting of tea during peak production (Kirui, 2020).

Another challenge is that some farmers lack digital literacy skills to adequately use and gain from digital tools. A study by Chepkemoui et al. (2023), revealed that majority of the tea farmers who are willing to integrate digital tools in managing their farms are those who are educated and well-informed on how to access and use digital tools. On the other hand, those who are not well educated are reluctant to use such tools, and thus, do not experience significant benefits that the tools provide when compared to those who are digitally competent. Another significant challenge entails employees resisting the use of mechanical tea harvesters. As per the research by Mulwa (2022), there have been recent strikes from employees after some of the tea companies in Kericho and Nandi wanted to lay-off many their workers. This also includes arguments on the deficiencies exhibited by some of the harvesting machines and some employees resorting to damaging some of the equipment (Mulwa, 2022). Moreover, a study by Momanyi et al. (2020) highlights high technology costs, lack of proficiency in ICT, and poor technological infrastructure, aspects that negatively impact tea research in Kericho and other tea-producing regions.

Table 4

Thematic Analysis of the challenges of digital technology for tea farmers in Kericho County, Kenya

Themes	Key Challenges	Articles
Impact on Tea Quality	<ul style="list-style-type: none"> <li>- Mechanization can deteriorate tea quality.</li> <li>- Comparison of hand-plucked vs. machine-plucked tea.</li> <li>- Deterioration due to non-selective plucking and mechanical injury.</li> <li>- Increased plucking level and decreased production cost.</li> </ul>	Kirui (2020)
Digital Literacy Skills	<ul style="list-style-type: none"> <li>- Lack of digital literacy among some farmers.</li> <li>- Reluctance to use digital tools among less-educated farmers.</li> <li>- Differences in benefits between digitally competent and less competent farmers.</li> </ul>	Chepkemoui et al. (2023)
Resistance to Mechanical Harvesters	<ul style="list-style-type: none"> <li>- Employees resisting the use of mechanical harvesters.</li> <li>- Strikes and disputes over job losses.</li> <li>- Arguments about deficiencies in the harvesting machines.</li> </ul>	Mulwa (2022)
Technology Costs and Infrastructure	<ul style="list-style-type: none"> <li>- High technology costs.</li> <li>- Lack of proficiency in ICT</li> <li>- Poor technological infrastructure.</li> </ul>	Momanyi et al. (2020)

***Recommendations to address the challenges faced by tea farmers in Kericho County due to the impact of digital technology***

A possible recommendation entails enhanced digital literacy training for the tea farmers in the county. As highlighted in the analysis, a majority of the tea farmers who are willing to integrate digital tools in managing their farms are those who are educated and well-informed on how to access and use digital tools (Chepkemoi et al., 2023). Digital literacy training will empower the tea farmers in Kericho County with the necessary skills to adequately utilize the technologies in their farming practices. Another recommendation entails the need for tea cooperatives such as KTDA to strengthen the agricultural extension services by integrating digital technology using aspects such as SMS and the existing mobile services such as DIGIFarm to reach more tea farmers. Also, tea farmers in the region should be educated and advised to invest in solar technology for them to have a reliable electricity supply so that they have constant access to digital technology. However, further research is needed to identify and fully comprehend the particular needs of tea farmers in Kericho County such that digital appropriate digital infrastructure is developed to meet their specific needs.

**Limitations of the Study**

A limitation associated with the study is that it was limited to existing data and to one County (Kericho County) and not to other counties that engage in tea farming. Although there are similarities in the practice of tea farming in these other counties, A wider study covering more counties would yield more information. Further research is needed to identify and fully comprehend the particular needs of tea farmers in Kericho County such that digital infrastructure is developed to meet their specific needs. This also entails the need for comparative studies among the counties that practice tea farming to check how they are impacted by digital technology and what the government can do to address the involved challenges to strengthen Kenya's economy.

**CONCLUSIONS**

The research shows that the integration of digital tools and practices has impacted the efficiency, productivity, and sustainability of tea farming in Kericho County. As per the analysis, the challenges faced by farmers are primarily associated with access to technology, digital literacy, and data security concerns including unemployment among the youth. Nonetheless, further research is necessary to identify and fully comprehend the needs of tea farmers in Kericho County such that digital infrastructure is developed to address their specific needs. Furthermore, there is need for formulation and enforcement of government policies that ensure that the welfare of farmers in the region is protected despite the mechanization of various processes and that farmers are informed on how they can take advantage of digital technology in their daily farming practices.

**BIBLIOGRAPHY**

- ALFRED, R., & BETT, A., 2018 – Information and Communications Technology Adoption and Performance of Tea Processing Companies in Kericho County, Kenya. *International Journal of Current Aspects in Social Sciences*, 2:23-33.
- AOKO, S., & MOSE, T., 2022 – ICT Adoption and Performance of Tea Farmers Payment by Co-Operative Societies in Kericho County, Kenya. *International Journal of Technology and Systems*, 7(2): 29–55. <https://doi.org/10.47604/ijts.1669>
- CHEPKEMOI, B. N., BERNARD, L., & MUCHELULE, Y., 2023 – Information communication technology integration and performance of tea farmers payment systems by co-operative societies in Kenya. *International Journal of Management and Business Research*, 5(1).



- EKWANG, C., 2021 – *Factors affecting adoption of improved agricultural technologies among smallholder tea farmers in Kericho County* (Doctoral dissertation, Strathmore University).
- FROESE, F. J., & BADER, K., 2019 – Surviving the desk-review. *Asian Business & Management*, 18:1-5.
- KARLSSON, B. G., 2022 – The imperial weight of tea: On the politics of plants, plantations and science. *Geoforum*, 130: 105-114.
- KILEL, E. C., 2019 – Optimization of brewing, processing conditions and their effects on the chemical and sensory quality of purple-leafed Kenyan tea (Doctoral dissertation, Egerton University).
- KILIMO NEWS., 2023 – KTDA unveils Mobile app, SMS, and USSD platforms for tea farmers. *Kilimo News*, <https://kilimonews.co.ke/general-news/ktda-unveils-mobile-app-sms-and-ussd-platforms-for-tea-farmers/#:~:text=The%20Kenya%20Tea%20Development%20Agency,over%20600%2C000%20smallholder%20tea%20farmers.>
- KIRUI, C. C., 2020 – Cost-Saving in Operational Mechanization Projects on Organizational Performance of Tea Firms. *East African Journal of Business and Economics*, 2(1): 1-9.
- MOMANYI, G. W., ARMURLE, G., & NYABOGA, Y., 2020 – The Relationship Between Intellectual Capital, Research and Development and Organizational Performance of Tea Processing Firms in Kenya. *International Journal of Academic Research in Business and Social Sciences*, 10(11): 360-383.
- MULWA, B. M., 2022 – *Efficiency Of Sawmilling Technology And Lumber Recovery In Kericho County, Kenya* (Doctoral dissertation, UOK).
- MUOKI, C. R., MARITIM, T. K., OLUOCH, W. A., KAMUNYA, S. M., & BORE, J. K., 2020 – Combating climate change in the Kenyan tea industry. *Frontiers in plant science*, 11: 339.
- SAETEURN, M., 2022 – Expanding Their Frontiers: The Enriching Lives of Rural Kenyan Tea Estate Laborers in the Late-Colonial and Post-Independence Era. *World History Connected*, 19(3).
- TARE, J., & SIMON, K. S. C., 2020 – *Tea Production Automation Influence on Selected Multinational Tea Companies Field Costs in Kericho and Bomet Counties, Kenya* (Doctoral dissertation, Doctoral Dissertation, Kenyatta University).
- TERER, K. M., & KIPKORIR, S. C. M., 2019 – Management practices and performance of tea companies in Kericho County, Kenya. *International Academic Journal of Human Resource and Business Administration*, 3(7): 410-424.