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The Relationship between Road Network Efficiency and the Performance of Tea Processing Industries in Murang'a County, Kenya

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Abstract: **Most developed countries have achieved their status through industrialization, which involves shifting capital and labour from agriculture to manufacturing. Unfortunately, Kenya has experienced a decline in the contribution of manufacturing to its GDP, with the tea processing industry being particularly affected. Despite the government's efforts, including implementing the latest industrialization policy and vision for 2030, which specifically aimed to boost manufacturing, the desired outcomes have proven elusive. In light of this challenge, the objective of this study was to investigate the relationship between road network efficiency and the performance of the tea processing industry in Kenya. The study drew upon resource dependency theory to provide a foundation for its investigation. The target population for the study consisted of 29,854 tea farmers in Murang'a County. From this population, a sample of 379 tea farmers was selected using quota sampling. Data for the study were collected through questionnaires, document analysis, and group interviews. The collected data were analyzed using descriptive measures, such as frequencies and percentages and inferential analysis utilizing Pearson's correlation. The results revealed a significant and strong positive relationship between road network efficiency and the performance of tea processing industries in Murang'a county ($r = .759$, $p = .001$ at $\alpha = .05$). Based on these findings; the study recommends that both the county and national governments make significant investments in road network infrastructure to enhance the performance of the tea processing industry to meet international standards.**

Keywords: **Road Network efficiency, Performance and Tea Processing Industries.**

1. BACKGROUND OF THE STUDY

Manufacturing is critical in adding value to products through various processes and resources (Liang, 2020). As manufacturing and infrastructure have evolved over time, it is essential to anticipate Kenya's changing industrial needs and make appropriate infrastructure investments. Infrastructure development necessitates long-term planning and substantial financial resources, which can significantly impact production patterns. Key financial, economic, and social infrastructures such as energy, telecommunications, roads, schools, housing, and health facilities facilitate large-scale manufacturing and efficient mass production.

The performance, productivity, and growth of the tea processing industry in modern countries heavily rely on establishing reliable and high-quality infrastructure, as emphasized by Kiptoo (2021) . The backward and forward linkages originating from the industry's financial, economic, and social systems are pivotal for its expansion. Studies conducted in the United

States, India, the European Union, and other regions have demonstrated that energy, transportation, and essential infrastructure investments enhance business productivity (Deepika, 2013; Graham et al., 2013). Economic infrastructure development promotes economies of scale, reduces production costs, improves productivity, and attracts investors, fostering industry growth. Furthermore, the development of social infrastructure enhances the quality of life for workers and boosts their overall performance (Zhu & Sun, 2009).

In Kenya, the industrial sector has been striving to accelerate growth and elevate the country to a developed nation with high-income levels. However, the contribution of the tea processing industry to the country's GDP has experienced a downward trend over the past three years, currently standing below 10%. The role of roads in the global manufacturing landscape continues to evolve, and emerging economies like Kenya are expected to drive increased demand for manufactured goods worldwide (Rothstein, 2015). Given these circumstances, it is crucial to investigate the factors contributing to the declining percentage of Kenya's GDP attributed to tea processing.

Previous research in Kenya has primarily focused on energy requirements, natural gas, green energy transformation, and waste management (Shuba & Kifle, 2018). However, no studies have specifically examined the relationship between road network efficiency and the performance of the tea processing sector. Therefore, this study aims to evaluate the correlation between road network efficiency and the performance of tea processing industries in Murang'a County. The study aimed to fill the research gap by exploring the specific relationship between road infrastructure and the performance of the tea processing industry.

To achieve this objective, the following null hypothesis was formulated for the study:

H_O: Road network efficiency has no statistically significant relationship with the performance of tea processing industries in Murang'a County.

By examining the relationship between road network efficiency and the performance of tea processing industries, this study sought to provide valuable insights into the factors influencing the industry's performance in Kenya. Additionally, the findings could inform policymakers and industry stakeholders on the importance of road infrastructure investments and guide future strategies for enhancing the tea processing sector's contribution to the country's GDP.

2. LITERATURE REVIEW

Researchers have already looked at the "Relationship between the Efficiency of the Road Network and the Performance of Tea Processing" on a global, regional, and local scale. One global empirical study, "Connecting to Compete 2018: Trade Logistics in the Global Economy" by Arvis(2019), looked at the relationship between the efficiency of road networks and the performance of trade logistics at 168 tea factories in different countries. The study used a cross-sectional research methodology and data from different sources, such as the World Bank Logistics Performance Index (LPI) and the World Economic Forum's Global Competitiveness Index (GCI). The study found that the efficiency of the road network is a key factor in how well trade processes work. Countries with better road infrastructure have more trade and lower trade costs.

Nevertheless, the study also said that building roads are insufficient to improve trade logistics. Instead, countries must also work on lowering trade barriers and better customs procedures to get the best results. This study aimed to fill a gap in knowledge about the link between the efficiency of Kenya's road network and the performance of its tea processing industries. Even though many studies have been done in other countries, there is not much real-world proof about the link between Kenya's road network and how well tea is processed.

You (2020) conducted a study, "Road Network Efficiency and Firm Productivity: Evidence from Chinese Manufacturing Firms", a world empirical study examining how road network efficiency and firm productivity were related in China. The study was based on a panel data research methodology, and the China Industrial Enterprise Database and the China Highway Statistics Yearbook were used to get the data. The study found that the speed of the road network greatly affects firms' productivity, with firms in areas with better road infrastructure being more productive. The study also found that the effect of a good road network on firm productivity is stronger for small and medium-sized businesses than for big businesses. However, the study found that the link between how well a road network works and how well a business does is complicated and depends on many things, such as how the business works and how different regions grow. A similar study needs to be done in Kenya because Kenya and China have different factors affecting their road networks' efficiency and productivity. This study was meant to fill that research gap.

Mamun (2021) looked at "Road Network Performance and Agricultural Productivity in Bangladesh", specifically looking at the link between the performance of the road network and the number of crops grown in Bangladesh. The study was based on a panel data research methodology, and the Bangladesh Bureau of

Statistics and the World Bank's World Development Indicators were used to collect data. The study found that the performance of the road network has a big good effect on agricultural productivity, with farmers in areas with better roads having higher levels of agricultural productivity. The study also found that high-value crops like vegetables and fruits benefit more from a good road network regarding agricultural output. However, the study said that building roads independently is insufficient to make agriculture more productive. It also said that investments in irrigation and farming extension services are needed. Conversely, the study looked at the relationship between road network efficiency and agricultural productivity. There is a need for a local study in Kenya that looks at the relationship between road network efficiency and tea factories since tea farming is a very important part of Kenya's economy.

Mwamfupe (2018) did a study in Africa called "The Impact of Road Transport Infrastructure on the Performance of the Agriculture Industry in Tanzania" to find out how road transport infrastructure and the performance of the agriculture industry in Tanzania are related. The study used a case study approach, asking 100 people to complete structured questionnaires to get primary data. The study showed that Tanzania's agriculture business does better with good roads and transportation infrastructure. Nevertheless, the study did not pay much attention to how well tea-processing companies did. To fill this gap, the goal of the current study was to look into how the development of road transport infrastructure affects how well tea processing businesses in Kenya do.

Mwaura and Karanja (2015) did a study in Kenya to find out how the country's transportation infrastructure affected the performance of small tea processing companies. The study aimed to find out how Kenyan small-scale tea processing companies' output levels are related to their transportation infrastructure, their ability to make things, and how much they can make. The study used a cross-sectional research method, and a sample of 220 small-scale tea processing firms was chosen through stratified random sampling. Structured questionnaires were used to get first-hand information for the project. The results showed that transportation infrastructure positively affected how much small tea processing companies could make and how much they made. However, the study did not just examine how well the road network worked. Instead, it looked at how Kenya's transportation infrastructure affected small tea-processing businesses' success. This study aimed to fill a gap in research that looked at the link between the efficiency of the road network and tea processing factories in Kenya.

Ndung'u and Kamau(2018) studied how well tea processing businesses in Kenya did concerning how well the road network worked. The goal of the study was to find out if there was a link between how well Kenya's road network worked and how well tea processing companies did. The study used a cross-sectional research method, and a sample of 54 tea processing companies was chosen by purposeful sampling. Structured questionnaires were used to get first-hand information for the project. The study used regression analysis to determine how tea processing companies' performance is related to how well the road network works. The results showed that there was a strong link between how well the road network worked and how well tea processing companies did. But the study's small sample size, so its results cannot be taken at face value. This left space for the current research, which used a big sample size to get more reliable results.

Further, the study also used resource dependency theory to provide a broader analysis of the topic. Resource Dependence Theory, proposed by Pfeffer and Salancik in 1972, offers valuable insights into how organizations interact with their external environment to acquire the essential resources necessary for their survival (Kairu, 2013). Recent studies have further supported the relevance of this theory, emphasizing the significance of firms collaborating with external entities to access critical resources (Zhang & Preece, 2011). Strategic alliances and partnerships are recognized as effective strategies for organizations to overcome the challenges of resource dependency (Zuiderwijk, 2015). Despite its strengths, Resource Dependence Theory also has limitations, including its limited applicability in complex business environments and its assumption of rational decision-making by organizations (Zhang & Preece, 2011). However, it still provides a valuable framework for understanding how organizations acquire resources in various contexts.

In the specific study exploring the impact of road transport infrastructure development on the performance of tea processing industries in Murang'a County, Kenya, Resource Dependence Theory proves particularly relevant. The theory suggests that these industries heavily rely on road transport infrastructure to acquire the necessary resources for their survival and operational performance (Kairu, 2013). By leveraging the infrastructure, such as efficient road networks, the tea processing

industries in the county can access the resources vital to their operations, including raw materials, equipment, and market connections. Thus, applying Resource Dependence Theory enables a deeper understanding of how the availability and utilization of road transport infrastructure influence the performance of tea processing industries in the region.

3. RESEARCH METHODOLOGY

This study employed a mixed-methods research strategy to comprehensively investigate the impact of road infrastructure efficiency on the success of the tea processing business in Murang'a County. By combining qualitative and quantitative methods, the study aimed to gather empirical evidence and enhance the reliability and validity of the findings (Omariba, 2023; Creswell, 2014).

The research design was carefully crafted to ensure a well-designed study, emphasizing the utilization of reliable information-gathering methods (Omariba, 2023) . The mixed-methods approach allowed for the integration of qualitative and quantitative data collection approaches, facilitating statistical analysis and further bolstering the credibility and validity of the study's results (Creswell, 2014).

According to Omariba (2022), research studies can be conducted in any geographic location as long as the individuals residing there can provide relevant information aligned with the research objectives. This study included all tea processing industries in Murang'a County as the research area. Murang'a County has a land area of 2325.8 km2 and a population of 1 ,056,640 individuals, resulting in a high population density of 450 /km2. The county comprises seven electoral constituencies, namely Kiharu, Kangema, Maragwa,

Kandara, Gatanga, Kigumo, and Mathioya, where several tea processing factories, such as Kiru, Ngere, Makomboki, and Nduti, are located. The abundance of individuals with relevant knowledge in this region made it a suitable location for data collection.

The study's target population consisted of 29,854 tea farmers from the four tea processing factories in the research area. The sample size of 379 tea farmers from 34 tea-buying centres was determined using the formula established by Krejcie and Morgan (1970). Proportionate quota sampling was employed to select respondents from tea processing firms in the research area. Quota sampling, as defined by Yang and Banamah (2014), ensures a proportional representation of participants from each factory in the research area, reflecting the distribution of important traits (strata) in the population. Quotas were calculated using the formula: Sample = (number of tea farmers in a given factory/total number of farmers) x 379, determining the sample size for each tea factory accordingly. Additionally, one director from each factory was selected, following Kerlinger's (1998) suggestion to include 10% of the target population.

Data collection involved the use of a questionnaire with a 5-point Likert scale comprising six closed-ended questions to gather information on the road network status from the selected tea farmers. To collect data on the dependent variable, which is the performance of the tea processing industries in the research area, a Document Analysis Guide (DAG) was developed, involving a comprehensive examination of the financial records of the sampled tea processing factories.

Before the main study, a pilot study was conducted three weeks earlier to ensure the accuracy of the research instruments. A sub-sample of 20 tea farmers was used for this purpose. The validity and reliability of the research instruments were assessed based on data collected from the pilot study, surpassing the thresholds set by George and Mallery (2003). Data analysis commenced with descriptive analysis, utilizing frequency counts and percentages. The inferential analysis employed Pearson's Product Moment Correlation Coefficient to test the hypothesis at a 95 % confidence level, examining the relationship between road network efficiency and the performance of tea processing industries in the research area.

4. RESULTS AND DISCUSSION

The objective of this study was to evaluate the relationship between road network efficiency and the performance of tea processing industries in Murang'a County. The independent variable of this objective was road network efficiency. Raw data on this variable was captured using all the statements in section C of the tea farmer's questionnaire. To this end, the sampled tea farmers in the research area were asked to fill out section C of the questionnaire for tea farmers, whose items sought information on the efficiency of road networks in the research area.

There were some remarks there that were expressed positively and others that were worded negatively. Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, and Strongly Disagree = 1 were the scores assigned to statements with a positive

tenor. Conversely, negatively phrased items were rated in the opposite sequence, i.e. Strongly Agree = 1, Agree = 2, Undecided = 3, Disagree = 4, and Strongly Disagree = 5. The greatest possible composite score was divided by 30, then multiplied by 100 to generate a composite score for all the statements in section C of the questionnaire. So, the respondent who received a score of 5 in each of the five assertions had a maximum score of 100%, while a respondent who received a score of 1 in each statement received a minimum score of 20%. The following Table 1 presents a summary of the responses to statements in section C of the questionnaire:

Table 1: Responses to Statements on Road Network Efficiency

STATEMENT	SD	D	N	A	SA
1. The loca on of the tea processing factory is good for all farmers	29	40	13	130	167
2. It takes a long me to transport my tea to the factory/buying centre	103	101	15	75	85
3. Much me is wasted while trying to access the tea-buying centres	83	91	12	98	95
4. Much me is consumed transpor ng tea from the buying centre to the factory	89	94	7	90	99
5. More needs to be done to improve the efficiency of the roads used to transport tea to the factory	29	20	8	149	173

Source (Field Data,2023)

Based on the results in Table 1, the first statement of the farmers' questionnaire sought to know whether the location of the tea processing factory was good for all farmers. Results in the Table indicate that of the 379 respondents selected, 29 (7.65%) strongly disagreed with the statement, while 40 (10.55%) disagreed. The Table also reveals that 13 (3.43%) respondents were undecided. Furthermore, the Table indicates that 130 (34.30%) of the respondents agreed, while 167 (44.06%) strongly disagreed with the assertion that the location of the tea processing factory was good for all farmers. These findings agree with the results of a study by Arvis (2019).

The second statement of the tea farmer's questionnaire sought whether it took a long time to transport my tea to the factory/buying centre. The Table indicates that of the 379 respondents selected, 103 (27.18%) strongly disagreed, while 101 (26.65%) disagreed. The Table also reveals that 15 (3.96%) respondents were undecided. Furthermore, the Table indicates that 75 (19.79%) of the respondents agreed while another 85 (22.43%) strongly disagreed with the assertion that it took a long time to transport my tea to the factory/buying centre. These findings are further supported by a study by You (2020).

The third statement of the tea farmer's questionnaire sought to know whether much time was wasted while trying to access the tea-buying centres. The Table indicates that of the 379 respondents selected, 83 (21.9%) strongly disagreed, while 91 (24.01%) disagreed. The Table also reveals that only 12 (3.17%) respondents were undecided. Furthermore, the Table indicates that 98 (25.86%) of the respondents agreed, while 95 (25.07%) strongly disagreed with the assertion that much time is wasted while trying to access the tea-buying centres. The findings are supported by a study by Mamum (2021).

The fourth statement of the tea farmer's questionnaire sought to know whether much time was consumed transporting tea from the buying centre to the factory. The Table shows that of the 379 respondents selected, 89 (23.48%) strongly disagreed with the statement, while 94 (24.80%) disagreed. The Table also reveals that 7 (1.85%) respondents were undecided. Moreover, the Table shows that 90 (23.75%) of the respondents agreed while 99 (26.12%) strongly disagreed that much time is consumed transporting tea from the buying centre to the factory. The findings agree with a study by Mwamfupe (2018).

The fifth statement of the tea farmers questionnaire ought to know from the sample tea farmers whether they felt more needs to be done to improve the efficiency of the roads used to transport tea to the factory. Results in the Table indicate that of the 379 respondents selected, 29 (7.65%) strongly disagreed with the statement, while 20 (5.28%) disagreed. The Table also reveals that only 8 (2.11%) respondents were undecided. Furthermore, the Table indicates that 149 (39.31%) respondents agreed. In comparison, 173 (45.65%) strongly disagreed with the assertion that more needs to be done to improve the efficiency of the roads used to transport tea to the factory. These results are further supported by a study by Mwaura and Karanja (2015).

From the findings, the study concludes that the efficiency of the road network plays a significant role in the performance of tea processing industries in Murang'a County. The responses from the tea farmers indicate that there are concerns regarding the location of the tea processing factory, the time taken to transport tea to the factory/buying centre, the time wasted in accessing tea buying centres, the time consumed in transporting tea from the buying centre to the factory, and the need for improvement in the efficiency of the roads used for tea transportation.

This finding concurs with a study by Bhattacharya (2018) , which established that road network efficiency directly impacts the performance of industries reliant on transportation for their inputs or outputs. The study found that organizations dependent on efficient road networks experienced enhanced operational efficiency and productivity. In contrast, those facing road network inefficiencies encountered delays, increased transportation costs, and reduced overall performance.

The study further sought to test the relationship between road network efficiency and the performance of tea processing industries in Muranga. The study used the Pearson correlation coefficient to test for this relationship, and the results are presented in Table 2.

Table 2: Correlation between Road Network Efficiency and Performance of TPI

VARIABLE	Road Network Efficiency	Performance of TPI
Road Network Efficiency	-	0.759 *
Performance of TPI	0.759 *	-

* $p < 0.001$, $\alpha = 0.05$

Source (Field Data,2030)

Based on the results in Table 2, there was a strong positive correlation between the sampled farmers' scores in the road network efficiency *[r=.759, p<.001* at *α=.05].* Since the computed Pearson's correlation coefficient is closer to 1 than to 0, the link is considered to be "strong," for this reason. Additionally, the correlation coefficient (r)'s sign is positive, which suggests that, according to the Table, which further supports this given, tea farmers' high road network efficiency also translates to a high-performance score for their tea processing industry and vice-versa. This agrees with studies by Skorobogatova and Kuzmina-Merlino, (2017) , whose study revealed that road network efficiency is the most important aspect of transport infrastructure as it significantly improved the performance of most tea processing industries. This calls for the Kenyan government to develop efficient road network status to support the tea processing industries in Kenya, as road network efficiency has been confirmed to greatly influence the performance of tea processing.

5. CONCLUSION

In conclusion, this study's findings revealed a significant and strong positive relationship between road network efficiency and the county's tea processing industries' performance. These results suggest that investing in road network infrastructure can enhance the performance of the tea processing industry, enabling it to meet international standards. Therefore, it is recommended that both the county and national governments prioritize significant investments in road infrastructure to support the growth and development of the tea processing sector in Kenya.

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