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The Relationship between Road Network Status and Performance of Tea Processing Industry in Murang'a County, Kenya

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Abstract: **Most developed countries achieved their status through industrialization, shifting capital and labor from agriculture to manufacturing. Unfortunately, Kenya has seen a decline in manufacturing's contribution to GDP, particularly impacting the tea processing industry. Despite government efforts, including the latest industrialization policy and vision for 2030, which specifically targeted manufacturing, the desired outcomes remain elusive. This study examined the link between road network status and tea processing industry performance in the Murang'a count to investigate this menace. Development theory was used to provide a basis for the study. The study target population was 29,854 tea farmers in Murang'a county, out of which a sample of 379 tea farmers was selected by quota sampling. The study data was collected via questionnaires, document analysis, and group interviews. The data were analyzed descriptively using frequencies and percentages and inferentially using Pearson's correlation. Results revealed; a significant strong positive relationship between road network status and the performance of tea processing industries in Murang'a county (r=.628, p=.001 at α=.05). Consequently, the study recommends significant investments by the County and national governments in road network infrastructure to enhance tea processing industry performance to international standards.**

Keywords: **Road Network Status, Performance, Tea Processing Industries.**

1. INTRODUCTION

BACKGROUND OF THE STUDY

Manufacturing is crucial in adding value to products by utilizing various processes and resources (Liang,2020). Over time, manufacturing and infrastructure have changed, and it is vital to anticipate Kenya's evolving industrial needs and make appropriate infrastructure investments. Infrastructure development requires long-term planning and significant financial resources. Additionally, infrastructure changes can impact production patterns. Essential financial, economic, and social infrastructures such as energy, telecommunications, roads, schools, housing, and health facilities facilitate large-scale manufacturing, enabling efficient mass production.

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

India, the European Union, and other regions have demonstrated that energy, transportation, and critical infrastructure investments improve business productivity (Deepika, 2013; Graham et al., 2013). Economic infrastructure development fosters economies of scale, reduces production costs, enhances productivity, and attracts investors, promoting industry growth. Furthermore, the development of social infrastructure improves the quality of life for workers and enhances 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 characterized by 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 becomes crucial to investigate the reasons behind the declining percentage of Kenya's GDP attributed to tea processing.

Previous research in Kenya has predominantly 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 status and the performance of the tea processing sector in Murang'a. Hence, the objective of this study was to evaluate the correlation between road network status and the performance of tea processing industries in Murang'a County. The null hypothesis of the study was formulated as follows:

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

2. LITERATURE REVIEW

Several studies have been done on the topic globally, regionally, and Kenya. To begin with, Xiang (2021) did a global study on how transportation infrastructure affects the Chinese tea business worldwide. The study's goal was to determine if there was a link between the good roads and how well the tea business worked. The tea businesses in the study area were chosen using a random sampling method and a quantitative research approach. The sample for the study was made up of 200 tea businesses. This study was collected using a questionnaire. The structured questionnaire was given to the managers of tea businesses as the tool for the study. The study used multiple linear regression to test the hypotheses. The results of the study showed that the road network's condition significantly impacts how well the Chinese tea business makes tea.

Nevertheless, the study was done in China, which has a different climate and other things that do not make it the same as Kenya. So, the study might not apply to Kenya. This created a gap in research that the current study on the effect of road transport infrastructure growth on the performance of tea processing industries in Kenya was meant to fill.

Bhattacharya (2018) also did a study called "Infrastructure, Value Chain, and Competitiveness of the Tea Industry: Evidence from India." The goal of the study aimed to examine the infrastructure, value chain, and competitiveness of India's tea business are related. The study used a cross-sectional poll to get information from 150 tea farmers in India. The primary data for the study came from a structured questionnaire, and regression analysis was used to look at the data. The study found that India's tea business was much more competitive, with easy access to good roads. The study also found that tea farmers who had roads were more effective than those who didn't have stressing how necessary transportation infrastructure is to the tea industry's value chain, which can help it become more competitive. But no one looked into how transportation infrastructure affects how well tea processing companies do their jobs. So, the current study, "The Impact of Road Transport Infrastructure Development on the Performance of Tea Processing Industries in Kenya," looks at the relationship between the state of the road network and how well tea processing industries in Kenya are doing. The goal of this study aimed to find out what part road transport infrastructure plays in making Kenya's tea processing industry more competitive and stable.

A similar study was also done by Akram (2020). It was titled "Infrastructure, Value Chain, and Competitiveness of Tea Industry: Evidence from Pakistan." This study examined how Pakistan's tea business's infrastructure, value chain, and competitiveness are related. This study used a cross-sectional poll research method, and the sample size was 300 tea producers. The primary data for this study came from a structured questionnaire, and regression analysis was used to look at the data. The study found that having access to good roads made Pakistan's tea business much more competitive. The study also found that tea farmers with good roads were more effective than those who did not have good roads. However, this research done in Pakistan shows that a similar study needs to be done in Kenya to understand how road infrastructure

affects the amount of tea that can be grown. This was the goal of this study, which looked at how developing Kenya's road transport infrastructure affects the efficiency of the tea processing businesses there.

Thanh (2021) also did a study called "The Role of transportation infrastructure in the sustainable development of the tea industry in Vietnam" to find out how transportation infrastructure affects the sustainable development of the tea industry in Vietnam. As part of a qualitative study method, semi structured interviews were done with tea growers, companies that transport tea, and factories that process tea. The study found that transportation infrastructure did not help the tea business grow sustainably by lowering transportation costs, making it easier to get to markets, or making tea better. The study also showed that Vietnam's transportation system was in bad shape, which mapmaking for the industry to grow shows that a similar study should also be done in Kenya. As a result of this, a study titled "The Impact of Road Transport Infrastructure Development on the Performance of Tea Processing Industries in Kenya" was done to fill the gap. This gap was meant to be filled by looking into how the condition of Kenya's road network affects how well its tea processing businesses do. The goal of study aimed to find out what part road transport infrastructure plays in making Kenya's tea processing industry more competitive and stable.

Mudalige and Jayasinghe (2021) looked at how infrastructure affects Sri Lanka's tea trade in the region. The authors used a quantitative study design and regression analysis to look at data from secondary sources. The study found that Sri Lanka's Road networks and seaports did not affect how much tea it exported. The study also found that infrastructure development was related to how well the tea business did with exports. Nevertheless, the study did not look into how the condition of roads affects how well tea processing businesses do. The research by Mudalige and Jayasinghe (2017) shows how necessary infrastructure is to the growth and competitiveness of the tea business. However, because their study focused on how well the industry did with exports, it left a hole that the current study, "The Impact of Road Transport Infrastructure Development on the Performance of Tea Processing Industries in Kenya," hopes to fill. In particular, this study wanted to find out how road transport infrastructure affects the productivity and viability of tea processing businesses in Kenya, which is the world's biggest exporter of black tea.

Also, Oyeyemi and Oke (2020) did a study called "The Impact of Road Network on Tea Industry Competitiveness in Nigeria." The study aimed to find out how Nigeria's road system affects how competitive its tea business is. This study is based on a cross-sectional survey, and the 120 tea factories in Nigeria that make up the group were chosen randomly. Using the survey questionnaire, raw data were collected, which were then looked at using regression analysis. The study results indicated a significant positive relationship between Nigeria's road system and how competitive its tea business is. The study showed that tea plants in areas with better roads were more competitive than those with worse roads. But the study also found that

Nigeria's roads must be fixed to make the tea business even more competitive. The results of this study show how important the state of the road network is to how competitive the tea business is. But the study didn't look into how the development of road transport infrastructure affects how well tea processing businesses do. The current study, "The Impact of Road Transport Infrastructure Development on the Performance of Tea Processing Industries in Kenya," was meant to fix this problem by looking at how the state of the road network affects how well tea processing industries in Kenya do their jobs. The study aimed to find out what part road transport infrastructure plays in making Kenya's tea processing industry more competitive and stable.

In Kenya, the topic of road network status and tea processing industries has been underrepresented. Willemen et al. (2019) studied the Upper Tana River basin, investigating the correlation between Kenya's road network and tea production. Their findings indicated a direct impact of road quality on tea output, with improved roads leading to increased production and lower transportation costs. Moreover, tea growers located near significant roadways demonstrated higher productivity. However, challenges related to inadequate transportation infrastructure hindered tea farmers' access to markets and affected the competitiveness of tea processing enterprises in remote areas. This study serves as a foundation for the present research, "The Impact of Road Transport Infrastructure Development on the Performance of Tea Processing Industries in Kenya," exploring how road transport infrastructure development has influenced the efficiency and competitiveness of Kenya's tea processing industry.

The development theory further expounded the study. Rostow, Rosenstein-Rodan, and Harrod-Domar founded the theory in the 20th century. The theory recognizes the influence of prior principles and norms on future policy. It asserts that public infrastructure investments, like highways, depending on the government and development agencies' perspectives on current

growth (Ulyssea, 2018). The theory highlights the importance of institutions in driving growth and emphasizes their formation and integration with projects. Institutions, such as the rule of law and property rights, play a crucial role in boosting economic growth and facilitating business operations (Jha & Singh, 2020). However, critics argue that growth theory overlooks cultural and historical aspects of growth and may prioritize institutional growth over social and human capital (Umaa-Taylor, Fine, 2019; Owusu & Odotei, 2020). Nonetheless, the theory provides valuable insights into the impact of public infrastructure spending on economic growth. By linkA, understanding the relationship between public infrastructure investment and economic growth in the tea processing industry can be achieved.

Colle, by linking the study to development theoryctively, these studies and the theory reveal the importance of transportation infrastructure, particularly roads, in facilitating the growth, competitiveness, and sustainability of the tea industry. However, limited research has specifically examined the impact of road network status on the performance of tea processing industries in Kenya. Therefore, the current study aims to address this research gap by investigating the relationship between road transport infrastructure development and the competitiveness and stability of Kenya's tea processing industry.

3. RESEARCH METHODOLOGY

In this study, a mixed-methods research strategy was employed to investigate the impact of road infrastructure status on the success of the tea processing business in Murang'a County. This approach allowed for the collection of empirical evidence through both qualitative and quantitative methods (Omariba, 2023). By integrating these approaches, the study aimed to enhance the reliability and validity of the findings (Creswell, 2014).

To ensure a well-designed study, the research design encompassed the methods and materials utilized to accomplish the study's objectives. Employing reliable information-gathering methods was emphasized (Omariba, 2023). The adoptee study achieved its objectives through a mixed-methods research approach and the disabled statistical analysis by integrating qualitative and quantitative data collection approaches (Creswell, 2014). This convergence of multiple methods strengthens the credibility and validity of the study's results.

According to Omariba (2023), a research study can be conducted in any geographic location as long as the individuals residing there can provide relevant information related to the research objectives. In this study tea processing industries in Murang'a County were included. Murang'a County occupies an area of 2325.8 km2 with a population of 1,056,640 individuals, resulting in a high population density of 450/km2, as supported by a study by Kinyajui(2016). The County is divided into seven electoral constituencies: Kiharu, Maragwa, Kandara, Gatanga, Kigumo, and Mathioya. Several tea processing factories, such as Kiru, Ngere, Makomboki, and Nduti, are located in this region. The substantial number of individuals with relevant knowledge in the region made it a suitable location for data collection.

The target population was 29,854 tea farmers from the four tea processing factories in the research area. The sample size was determined to be 379 tea farmers from 34 tea-buying centres, calculated using the Krejcie and Morgan (1970) formula. This study employed proportionate quota sampling to select respondents from tea processing firms in the research area. Quota sampling, defined by Yang and Banamah (2014) as selecting research participants that accurately reflect the distribution of essential traits (strata) in the population, ensures a proportional representation of farmers from each factory in the research area. The quotas were calculated using the formula: Sample = (number of tea farmers in a factory/total number of farmers) x 379. The sample size for each tea factory was determined accordingly. Additionally, one director from each factory was selected based on Kerlinger's (1998) suggestion of including 10% of the target population.

For data collection, a questionnaire with a 5-point Likert scale consisting of six closed-ended questions was used to collect information on the road network status from the selected tea farmers. To gather 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 by the researcher. This involved a thorough examination of the financial records of the sampled tea processing factories, with the researcher completing the DAG.

A pilot study was conducted three weeks before the main study 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 using data collected from the pilot study, surpassing the thresholds set by George and Mallery (2003). Data analysis commenced with descriptive analysis, employing frequency counts and percentages. The inferential analysis utilized Pearson's Product Moment Correlation Coefficient to test the hypothesis at a 95% confidence level, examining the relationship between road infrastructure development and the performance of tea processing industries in the research area.

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4. RESULTS AND DISCUSSION

This study aimed to assess the relationship between road network status and the performance of tea processing industries in Murang'a County. The independent variable in this objective was the road network status in the research area. Raw data on this variable was collected using all six statements in the Tea Farmers Questionnaire. To this end, the sampled tea farmers in the research area were asked to fill out the questionnaire for tea farmers. Some statements were positively worded, while others were negatively worded. Positively worded statements were scored as follows; Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, and Strongly Disagree = 1.

Negatively worded statements were, conversely, scored in the reverse order, i.e., Strongly Agree = 1, Agree = 2, Undecided = 3, Disagree = 4, and Strongly Disagree = 5. A composite score for all the statements in the questionnaire was determined and converted into percentages by dividing it by 30, the maximum possible composite score, and multiplying the quotient by 100. Therefore, the maximum possible score was 100% (for the one who scored 5 in each of the 6 statements), while the minimum possible score was 20% (for a respondent who scored 1 in each of the statements). The first statement sought whether the roads from tea farms to the tea factory were poor. Responses to this statement were analysed by computing frequencies and percentages, as shown in Table 1;

Table 1: Responses on whether the roads from tea farms to the tea factory were in a poor state

Response	Frequency	Percent
Strongly Disagree	150	39.58
Disagree	164	43.27
Undecided	5	1.32
Agree	36	9.50
Strongly Agree	24	6.33
Total	379	100.0

Based on the results in Table 1, out of 379 respondents, 150 (39.58%) strongly disagreed with the statement, while 164 (43.27%) disagreed. The Table also reveals that only 5 (1.32%) respondents were undecided. Furthermore, the Table indicates that 36 (9.5%) of the respondents agreed, while 24 (6.33%) strongly disagreed with the assertion that the roads from their respective tea farms to the tea factory were in a poor state. This agrees with Xiang's (2021) and Bhattacharya's (2018) studies.

The second statement in the questionnaire sought to know whether the topography of the roads from tea farms to the factory was terrible. The frequencies and percentages of the responses to this statement were as shown in the following Table 2;

Table 2: Responses on whether the topography of roads from tea farms to the factory was bad

Response	Frequency	Percent
Strongly Disagree	158	41.69
Disagree	162	42.74
Undecided	3	0.79
Agree	28	7.39
Strongly Agree	28	7.39
Total	379	100.0

The Table indicates that of the 379 respondents selected, 158 (41.69%) strongly disagreed with the statement, while 162 (42.74%) disagreed. The Table also reveals that only 3 (0.79%) respondents were undecided. Additionally, the Table indicates that 28 (7.39%) respondents agreed. In comparison, an equal number of 28 (7.39%) strongly disagreed with the assertion that the topography of roads from tea farms in the research area to the factory was terrible. This is in agreement with a study by Akram (2020).

The third statement in the questionnaire sought to know whether the lack of compactness of the road from the tea farms to the factory made the entire road impassable during the rainy season. The frequencies and percentages of the responses to this statement were as shown in the following Table 3;

Table 3: Responses on whether the lack of compactness of the road from tea farms to the factory made it impassable during the rainy season

Response	Frequency	Percent
Strongly Disagree	172	45.38
Disagree	175	46.17
Undecided	8	2.11
Agree	10	2.64
Strongly Agree	14	3.69
Total	379	100.0

As the Table indicates, 172 (45.38%) of the sampled tea farmers strongly disagreed with the statement, while 175 (46.17%) disagreed. The Table also reveals that only 8 (2.11%) respondents were undecided. Moreover, the Table shows that 10 (2.64%) respondents agreed. In comparison, 14 (3.69%) strongly disagreed with the assertion that the lack of compactness of the road from my tea farm to the factory made it impassable during the rainy season. This is in agreement with a study by Thanh (2021).

The fourth statement in the tea farmers' questionnaire sought whether the alternative roads from the tea farms to the tea factory were in poor condition. The responses to this statement were analysed by computing frequencies and percentages as shown in the following Table 4;

Table 4: Responses on whether the alternative roads to the tea factory were in poor condition

Response	Frequency	Percent
Strongly Disagree	112	29.55
Disagree	114	30.08
Undecided	11	2.90
Agree	78	20.58
Strongly Agree	64	16.89
Total	379	100.0

The Table shows that of the 379 sampled respondents, 112 (29.55%) strongly disagreed with the statement, while 114 (30.08%) disagreed. The Table further reveals that only 11 (2.90%) respondents were undecided. Furthermore, the Table indicates that 78 (20.58%) of the respondents agreed, while 64 (16.89%) strongly disagreed with the assertion that the alternative roads to the tea factory were also in poor condition. The findings agree with a study by Mudalige and Jayasinghe (2021).

The fifth statement in the tea farmers' questionnaire sought to know if the nature of roads to the tea factory needed to be improved. The frequencies and percentages of the responses to this statement were as shown in the following Table 5;

Table 5: Responses on whether the nature of roads to the tea factory needed to be improved

Response	Frequency	Percent
Strongly Disagree	12	3.17
Disagree	20	5.28
Undecided	6	1.58
Agree	148	39.05
Strongly Agree	193	50.92
Total	379	100.0

The Table indicates that of the 379 respondents selected, 12 (3.17%) strongly disagreed, while 20 (5.28%) disagreed. The Table also reveals that only 6 (1.58%) respondents were undecided. Furthermore, the Table indicates that 148 (39.05%) of the respondents agreed, while 193 (50.92%) strongly disagreed with the assertion that the nature of roads from their farm to the tea factory needed to be improved. This agrees with a study by Oyeyemi and Oke (2020).

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The sixth statement in the questionnaire sought to know from the sampled tea farmers whether the road tracks from their respective tea plantations to their tea-buying centers should be expanded. The frequencies and percentages of the responses to this statement were as shown in the following Table 6;

Table 6: Responses on whether the tracks to the tea buying center should be expanded

Response	Frequency	Percent
Strongly Disagree	86	22.69
Disagree	88	23.22
Undecided	9	2.37
Agree	89	23.48
Strongly Agree	107	28.23
Total	379	100.0

The Table indicates that of the 379 respondents selected, 86 (22.69%) strongly disagreed with the statement, while 88 (23.22%) disagreed. The Table also reveals that only 9 (2.37%) respondents were undecided. Furthermore, the Table indicates that 89 (23.48%) of the respondents agreed, while 107 (28.23%) strongly disagreed with the assertion that the tracks to the tea buying Centre should be expanded.

This agrees with a study by Kinyua and Nyaga (2020).

The dependent variable for this study was the performance of tea processing industries in the research area. Data on this variable was collected using the document analysis guide. The performance indicators included; customer satisfaction, public opinion, employee satisfaction, profit margins, and labor turnover. All five indicators were on a 3-point Likert scale, which was scored as follows; Below average = 1, average = 2, and above average = 3; a composite score for all the statements in the document analysis guide was determined and converted into percentage by dividing it by 15, the maximum possible composite score and multiplying the quotient by 100. This generated interval data, further analyzed by computing means and standard deviations as presented in the Table 7 .

Table 7: Performance of Tea Processing Industries in Murang'a County

Factory	Performance Indicator					
	Customer satisfaction	Public opinion	Employee satisfaction	Profit margin	Labor turnover	Mean
Makomboki	67	72	59	61	65	64.8
Ngere	73	71	61	64	54	64.6
Kiru	72	55	49	57	83	63.2
Nduti	66	59	61	65	78	65.8

As the Table shows, the top-performing tea processing factory in the research area was Nduti, with an average score of 65.8% for all five performance indicators, followed by makomboki, Ngere, and Kiru at

64.8%. 64.6% and 63.2%, respectively.

The null hypothesis of the study was:

H_O: ***There is no significant relationship between road network status and the performance of tea processing industries in Murang'a County.***

This hypothesis was tested inferentially using Pearson Product-Moment Correlation Coefficient, whose results were as displayed in the following Table 8:

Table 8: Correlation between Road Network Status and Performance of TPI

VARIABLE	Road Network Status	Performance of TPI
Road Network Status	-	0.628*
Performance of TPI	0.628*	-

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

As we can see from the Table, there was a strong positive correlation between the sampled farmers' scores in the road network status questionnaire and the scores of their respective tea processing industries as measured by the document analysis guide *[r=.628, p<.001* at *α=.05]*. This is because the Pearson's correlation coefficient obtained is closer to 1 than 0, hence the description of the association as 'vital. Furthermore, it can be observed from the Table that the sign of the correlation coefficient (r) is positive, which implies that a given tea farmer's high road network status also translates to a high-performance score in their tea processing industry and vice-versa. All these revelations contradict the assertion of the null hypothesis, which was consequently rejected because empirical evidence from data collected by the farmer's questionnaire and that collected by the document Analysis Guide suggested otherwise. It can be asserted that there is a significant strong positive association between road network status and the performance of tea processing industries in Murang'a county.

The positive value of the correlation coefficient implies that a farmer's high rating of their road network status also had their TPI performing well and vice-versa. This association is statistically significant because the p-value associated with the calculated correlation coefficient is less than the stipulated alpha value. These findings are similar to those of Verdoorn (1949), whose empirical study concerned regularity between the growth of output in tea processing and labour productivity in manufacturing concerning road network status. Verdoorn's law (second law) regarding the theoretical interpretation of the connection between productivity growth and tea processing output growth has generated a lot of theoretical and empirical secondary literature about its interpretation. According to Verdoorn (2019), "one could have expected a priori to find a correlation between road network status and performance output, given that the division of labour only occurs through increases in the volume of tea production. Therefore, improving road network status creates the possibility of better performance f the tea respective tea processing industry".

5. CONCLUSION

Based on empirical evidence arising from data that were collected in this study using mixed methods investigation, the primary conclusion arrived at is that tea farmers from regions in the research area, which have a good road network status, also have their respective tea processing industries performing significantly better than those from regions in the research area with poor road network status and vice versa. The 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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