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Transport Management Systems and Supply Chain Performance of Tea Factories in Meru County

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Abstract

Purpose: This study sought to assess the influence of Transport Management Systems on Supply Chain Performance of Tea Factories in Meru County.

Methodology: The theory adopted in this study was, Material Flow Theory. This study utilized Analytical Cross-Section Research Design, while the target population was 1,230 respondents, with a sample size of 302. Data collection instruments comprised of primary data, using questionnaires. Content and Construct validity were used to check the validity of research instruments. Descriptive statistics tools including mean, mode, standard deviation and variances were used. The research data was investigated for the adherence to the assumptions of multiple linear regression analysis with the help of ordinary least square assumptions, and it was found to be free from Normality, Multi-collinearity and Auto-correlation.

Findings: Inferential statistics in form of correlation and multiple regression analyses were employed. Correlation results show that the correlation coefficient between Transport Management Systems and Supply Chain Performance is r=0.610. The research hypotheses was tested and the Hypothesis value was 0.000. The following are multiple regression results: The R squared value is 0.372, while adjusted R Square is 0.369. When it comes to ANOVA test, the F value was 165.00 and p value was 0.000. The significant test results for the overall model indicate that Transport Management Systems had a coefficient of 0.610. It was concluded that Transport Management Systems highly influenced Supply Chain Performance by optimizing transport operations and easing their visibility.

Unique Contribution to Theory, Practice and Policy: The following recommendations were made: Examining the utilization of digital platforms that expedite communication between Tea Farmers and Factories, Assessing the influence of Digital Logistics Systems on empowering smallholder Tea farmers by building on access to markets, fair pricing and timely logistics and how implementation of Transport Management Systems in Tea Factories can affect the competitiveness of Meru's Tea in international markets.

Keywords: *Transport Management Systems, Supply Chain Performance, Tea Factories*

1.0 INTRODUCTION

1.1 Background of the Study

The effectiveness of transportation can break or make a Supply Chain (Muhalia et al., 2021). As organizations strive to meet growing consumer demands, trim operational costs and navigate elaborate logistics networks, the need for intelligent transport solutions has become more essential than ever (Muhalia et al., 2021).Transport Management Systems offer a robust answer to these bottlenecks. In recent years, Transport Management Systems have become the backbone of modern logistics and transportation operations because of their capability to accurately and efficiently connect different Supply Chains all over the globe (More et al., 2022). The origins of Transport Management Systems can be traced back to the early stages of organized commerce during the industrial revolution. This resulted due to the need for more effective ways to handle product distribution increase along with the growth of commerce. Early Transport Management Systems were basic, using paper-based documentation, manual techniques and basic computer programs for tracking and creation of Logistics plan (Lokhande et al., 2022).

However, these systems were plagued with challenges such as; mistakes, hold-ups and loss of real-time visibility until the advent of cloud-computing. Cloud –computing led to the ushering of modern-day Transport Management System solutions that provide real-time monitoring, predictive analytics and smooth connectivity with other business enterprise systems by utilizing cutting-edge technologies such as: Block-chain, Artificial Intelligence, Machine Learning and the Internet of Things (Tadesse et al., 2021). Processes carried out by Transport Management Systems are: Order Management, Shipment rate management, Tendering, Load Planning, Fleet Management, Dock scheduling and Document management and settlement (Muhalia et al., 2021).

Transportation management systems assist businesses streamline their transportation operations and improve their overall business processes. More et al (2022), adds that having a transport management system that is well – designed and equipped helps in carrying out the following functions: To move goods from the manufacturing or stockholding point to customer locations in the fastest and most cost-effective way possible, To future proof one's business by preparing for growth, managing change and exploiting new opportunities, To improve transport trafficking, reliability, integrity and real-time supply chain visibility (Lokhande et al., 2022). As much as Transport Management Systems have gained traction in modern-day Logistics industry, there is a gap when it comes to the uptake of Transport Management Systems in the Agro-processing industry in Kenya, specifically Tea Factories.

1.2 Statement of the Problem

According to Lokhande et al (2022), in today's Supply Chain, the importance of Transport Management Systems cannot be disputed. This is because Transport Management Systems focuses on optimizing the Transportation segment of the whole Supply Chain. Despite the critical role transport management systems (TMS) play in enhancing supply chain efficiency, many tea factories continue to face persistent challenges related to logistics and transportation. These gaps in transport management, such as: inadequate infrastructure, poor planning, lack of real-time tracking, limited use of technology, and untrained personnel have significantly hindered the overall performance of supply chains in the tea industry (Drolet et al.2023).

In regions like Meru County where tea is a major cash crop, delays in transporting green leaf from farms to factories often result in quality deterioration, increased operational costs, and reduced competitiveness in both local and international markets (Dong et al.2023). Additionally, the absence of integrated transport systems and performance monitoring tools has led to inefficiencies that compromise timely delivery, customer satisfaction, and profitability. These challenges indicate an urgent need to assess the gaps within existing transport systems and their impact on the supply chain performance of tea factories. Without addressing transportation issues, tea producers may continue to face logistical setbacks that undermine productivity and market access (Wamalwa, 2019).

1.3 Research Objective

To assess the influence of Transport Management Systems on Supply Chain Performance of Tea Factories in Meru County-Kenya.

1.4 Research Hypothesis

H_{01} Transport Management Systems have no significant influence on Supply Chain Performance of Tea Factories in Meru County-Kenya.

2.0 LITERATURE REVIEW

2.1 Literature Review

2.1.1 Theoretical Literature Review

Back in 1985, a Chinese scholar, Shoubo Xu, proposed a new theory called Material Flow (MF) theory (Gordanna and Luka, 2019). The MF theory gives an account of the path taken by materials or products from procurement to sales within or between companies. It is inclusive of all processes and stations through which the material or product passes, such as production, storage, picking and distribution. The Material Flow Theory underpins the concept of Transport Management Systems in the following ways: Optimizing Material Flow: MF theory advocates for seamless and uninterrupted flow of goods to reduce delays and inefficiencies, TMS contributes to that function by, optimizes routing, scheduling, and carrier selection to ensure that materials move efficiently from suppliers to manufacturers, and from warehouses to customers.

This aligns with the theory’s goal of smooth material flow. Minimizing bottlenecks: MF theory Identifies and eliminates bottlenecks in material movement to enhance overall supply chain performance, while TMS fulfills that by using real-time tracking and analytics to identify delays in transportation, such as traffic congestion or carrier inefficiencies, and provides alternative solutions to keep materials moving without interruption (Shadibekova & Ismoilov, 2021).

2.1.2 Empirical Literature Review

Transportation is one of the most critical components of agricultural supply chains, particularly for products that are perishable and time-sensitive, like tea leaves. The effectiveness of transportation influences not only the speed at which products reach processing centers but also their quality and market value. Szymczak (2019), emphasizes that transportation is a strategic function that links supply chain actors, from input suppliers and farmers to processors, distributors, and retailers.

In the case of tea, the harvested green leaves must be transported from farms to factories within a few hours to preserve quality and avoid fermentation before processing. Any delay in this process can result in quality deterioration, which directly affects the final product and pricing. Fatorachian & Kazemi (2021) highlights that transportation inefficiencies in agriculture are among the leading causes of post-harvest losses in developing countries. These inefficiencies stem from inadequate road networks, outdated transport equipment, and poor logistical planning.

In the twenty-first century, transportation systems have evolved digitally into Transport Management Systems (Mwangi et al., 2022). Transport Management Systems (TMS) are software platforms and logistical tools used to manage, optimize, and track the movement of goods from one point to another within a supply chain. These systems are designed to enhance transportation planning, execution, and monitoring. According to Wamalwa (2019), TMS helps organizations reduce costs, improve delivery accuracy, and increase supply chain visibility. TMS can include features such as route optimization, load planning, freight auditing, and real-time vehicle tracking.

In the context of agribusiness, where logistics involves transporting bulky and perishable goods from farms to processing facilities or markets, TMS is particularly valuable. Effective use of TMS enables agricultural producers to minimize delays, reduce post-harvest losses, and ensure better coordination between different actors in the supply chain (Saleem, 2020). However, the adoption of TMS in many agricultural settings, especially in developing economies, remains restricted due to resource constraints, technological gaps, and infrastructure challenges.

Studies have shown that there is a strong correlation between implementation of Transport Management Systems and performance of Supply Chains. A study by (Muhalia et al., 2021), which focused on the effect of Transport Management Systems on the findings indicated that Transport Management Systems significantly influence Supply Chain Performance. However, the challenge that most companies face, is implementing and adopting the Transport Management Systems. This is because there are massive costs incurred in the process, and finding the right professionals to assist in implementing the systems.

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Another stumbling block that managers face is, lack of coordination between parties involved like: manufacturers, drivers and managers. Despite the challenges faced by organizations when implementing Transport Management Systems, Herold et al. (2021) stated that, from 2019 through 2025, the TMS market is expected to enlarge to $4.88 billion, mirroring an accumulated yearly development pace of 15.1%. Adoption rates are also increasing as companies turn to third-party vendors to tap into the value of a cloud-based platform. TMS has in recent years, expanded to incorporate additional characteristics that can manage real-time asset management, yard management, event management with shipment tracking, shipping demand forecasting, palletization, import/export documentation, multimodal operations, hazardous material transportation, reverse logistics, and performance management (Shadibekova & Ismoilov, 2021).

2.1.3 Conceptual Framework

A conceptual framework is a diagram which the researcher believes can explain the natural progression of a particular phenomenon to be studied (Bhushan & Alok, 2019). It is linked with the concepts, empirical research and important theories used to promote and systemize the knowledge advocated by the researcher (Bhushan & Alok, 2019). In his study of the impact of Transport Management Systems on Supply Chain Performance of firms dealing with Fast Moving Consumer Goods, Muhalia (2021), notes that TMS impacts Supply Chain Performance, in the following ways: Assists firms to gain real-time visibility into their shipments, helps track products as they move about, in the Supply Chain, enhance data-driven decision-making and timely-delivery of products. The following conceptual framework shows the relationship between Transport Management Systems and Supply Chain Performance.

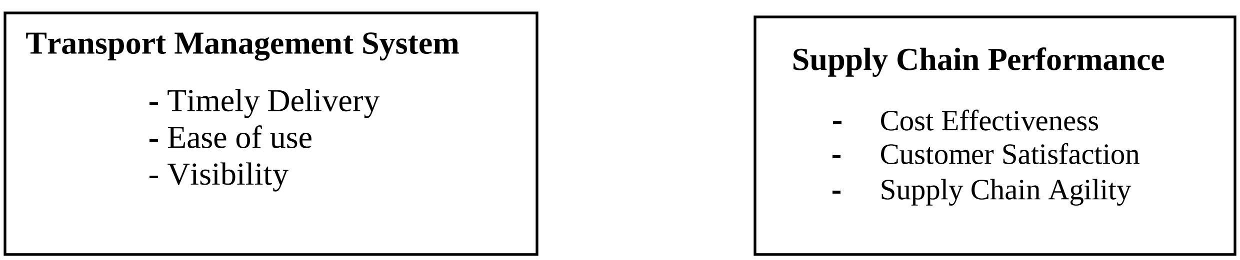

Figure 1 Conceptual Framework

3.0 METHODOLOGY

This section will outline the research design, scope of the study, Research model, target population, Sampling procedures and sample size, Research Instruments, Piloting, Reliability and validity of measuring tools, Procedures for gathering data, methods of Data Analysis and Ethical issues. The study adopted Analytical Cross-Section research design, which is done when data is collected at one point in time to analyze the relationship between variables (Adel, 2022). The reason for choosing this design is because the study seeks to describe the relationship between Transport Management Systems and Supply Chain Performance.

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The research model is responsive evaluation. In Responsive evaluation the study seeks to evaluate how responsive a particular phenomenon is to another phenomenon. Responsive evaluation also takes into account data collection, evaluation and suggested changes (Medawar, 2019).Given the fact that the research seeks to evaluate how responsive a particular phenomenon is to another phenomenon. Responsive evaluation also takes into account data collection, evaluation and suggested changes.

The unit of observation was seven Tea Factories located in Meru County namely: Githongo, Kionyo, Imenti, Njeru, Igembe, Kiegoi and Kinoro. The research approach was quantitative in nature. Quantitative research is a type of research that endeavours to collect and analyze numerical data to explore patterns, test theories, and make predictions (Willie, 2023). This research has adopted quantitative research because the study seeks to collect and analyze numerical data, then describe the relationship between Transport Management Systems and Supply Chain Performance. The target population was 1,230 respondents who comprised of; Supply Chain Officers, Finance Officers, Information Technology officers, Production officers and Quality Assurance officers. Sample size was 302. Stratified sampling technique was applied to sample the target population. This is because the population has different characteristics.

The sample size was ascertained using the Slovin‘s formula. Purposive selection was done when selecting respondents. Purposive selection is done when the researcher intentionally selects specific individuals or groups because they have specific knowledge, experience, or characteristics relevant to the research (Mumtaz Ali Memon et al., 2020). In this research, purposive selection was carried out because the respondents should have specific characteristics, knowledge, or experience that are relevant to the researcher's study.

Data collection instruments comprised of both primary and secondary data, with questionnaires being used as the primary source of data, and reports, journals and books being used as secondary sources of data. Representation of data was done through tables. Data was processed by editing, coding, entering and cleaning the data. Data collected was analyzed through both descriptive and inferential statistics with the help of SPSS version 27.

Some of the Ethical issues that come up during Research are: conflicts of interest, data falsification, disrespect of participants' rights and plagiarism (Drolet et al., 2023). The researcher took care of these issues the following ways: Ensure that all the data collected is original and gives an actual representation of the situation on the ground, brief all the respondents about the objective of the study before hand and assure confidentiality about the data they provide.

4.0 DATA ANALYSIS AND PRESENTATION

This section outlines data analysis results recorded after collection of data. The following sub-titles will be covered: Pilot test results, Response rate, Demographics and general information, Descriptive analysis of the study variables, Diagnostic tests and Inferential Statistics.

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www.carijournals.org

4.1 Pilot Test Results

4.1.1 Reliability of Research Instruments

Reliability of Research Instruments is calculated using the Cronbach's Alpha formula. To interpret Cronbach's Alpha, one can follow these general guidelines: 0.9 ≤ α: Excellent reliability, 0.8 ≤ α < 0.9: Good reliability, 0.7 ≤ α < 0.8: Acceptable reliability, 0.6 ≤ α < 0.7: Questionable reliability, 0.5 ≤ α < 0.6: Poor reliability, α < 0.5: Unacceptable reliability (Shakir & Rahman, 2022).

In this study, the Cronbach's Alpha for Transport Management Systems was 0.784 which translates to acceptable reliability as shown below, this indicates that there is a high degree of interrelatedness among the variables showing that the questionnaire had met the requirements of the reliability test.

Table 1: Summary of Cronbach's Alpha Reliability Test Results

Variables	Number of Items	Cronbach's Alpha Results
Transport Management Systems	6	0.784

4.1.2 Validity of Research Instruments

In this study, Content validity was measured through expert judgment which means that Subject matter experts or individuals with expertise in the content area review the items or questions in the measurement instrument and provide feedback on the basis of their knowledge and experience (Rozali et al., 2022). They assess the relevance, representativeness, clarity, and comprehensiveness of the items and offer suggestions for improvement. Construct validity was measured through Factor Loading Test as shown in the table below:

Table 2: Factor Loading Results for Transport Management Systems and Supply Chain Performance

	Initial	Extraction
Transport Management Systems	1.000	.841

From the Factor Loading results shown above, the value of Transport Management Systems variable is closer to +1 indicating a strong positive relationship between the variable and the factor.

4.2 Demographics and Response Rate

A total of 302 questionnaires were issued to sampled respondents whose number correspond to 302. However, the number of questionnaires that were filled and collected were 280. This brought the response rate to about 92.71%. According to (Luo, et al, 2020), a response rate is deemed acceptable for analysis when it crosses the 50% threshold. In this study, the response rate was

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Vol. 9, Issue No.7, pp 73 - 92, 2025

92.71%, making it adequate for analysis. In this research, it was pertinent to distribute respondents by Designation, so as to find out the respondents' perspectives from a professional point of view concerning the relationship between Digital Logistics Systems and Supply Chain Performance of Tea Factories. The results of the analysis are shown in Table 3.

Table 3: Distribution of Respondents by Designation

Designation	Frequency	Percent
Supply chain officer	154	55.0
Finance officer	35	12.5
IT officer	25	8.9
Quality assurance officer	25	8.9
Production officer	34	12.1
Marketing officer	7	2.5
Total	280	100.0

The study noted that the largest percentage of respondents were Supply Chain Officers at 55%, followed by finance officers at 12.5%, Information Technology officers at 8.9%, quality assurance officers at 8.9%, production officers at 12.1% and others at 2.5%.

4.3 Descriptive Analysis

The study requested the respondents to give their opinions in relation to; Transport Management Systems and Supply Chain Performance. The researcher used a Likert scale to collect the responses, and the responses were on a scale of 1,2,3,4 and 5, which represented; strongly disagree, disagree, neutral, agree and strongly agree. The responses they gave were analyzed, and their findings are presented in this section, in form of means and standard deviation.

4.3.1 Transport Management Systems

The study gauged the views of the respondents in regards to Transport Management Systems. The findings are illustrated in Table 4.

International Journal of Supply Chain and Logistics
ISSN 2520-3983 (Online)
Vol. 9, Issue No.7, pp 73 - 92, 2025

Table 4: Descriptive Statistics for Transport Management Systems

Transport Management Systems	**N**	**Mean**	**SD**
Transport management systems reduce lead time	280	4.93	0.309
Transport management systems improves sales as a result of timely delivery	280	4.87	0.335
Transport management systems ease transport operations	280	4.89	0.310
Transport management systems optimize transport operations	280	4.88	0.323
Transport management systems ease visibility of operations	280	4.84	0.365
Transport management systems curb unnecessary costs	280	4.85	0.399
Average Score	**280**	**4.88**	**0.340**

The study observed that respondents agreed (mean = 4.93; std dev = 0.309) that Transport Management Systems reduce lead time, hence improving the performance of Supply Chain. Respondents agreed (mean = 4.87; std dev = 0.335) that Transport Management Systems improve sales. Respondents also noted that Transport Management Systems ease transport operations at (mean = 4.89; std dev = 0.310). According to the statistics, it was also noted that Transport Management Systems optimize transport operations at (men = 4.88; std dev = 0.323).

Respondents agreed that Transport Management Systems ease visibility of operations in the Supply Chain at (mean = 4.84; std dev = 0.365). Respondents also agreed that Transport Management Systems curb unnecessary costs caused by delays. The statistics observed in this study concur with those of (Sapate et al., 2022), whose study involved the influence of Transport Management Systems on Supply Chain Performance of manufacturing companies.

The mean for all the constructs measured in transport management systems ranged between 4.5 to 4.9, asserting that Transport Management Systems positively influence Supply Chain Performance. An open-ended question concerning the challenge that many Organizations faced when installing Transport Management Systems was introduced. Of the 280 respondents, 168 respondents cited cost as a major challenge, 56 respondents cited lack of trained personnel and 56 more cited lack of awareness among employees.

Another study by (Geoffrey, 2021), indicated similar results in his study that outlined The effects of Transport Management Systems. The mean of all the constructs mentioned when it comes to measuring the impact of Transport Management Systems, ranged between 4.45 to 4.7. The average mean is 4.88, and Standard Deviation is 0.3401. Using the above findings, one can conclude that Transport Management Systems positively influence Supply Chain Performance of Tea Factories through enhancing real-time visibility of Transport operations. However, the major setback that firms face when installing these systems, is the costs of installation.

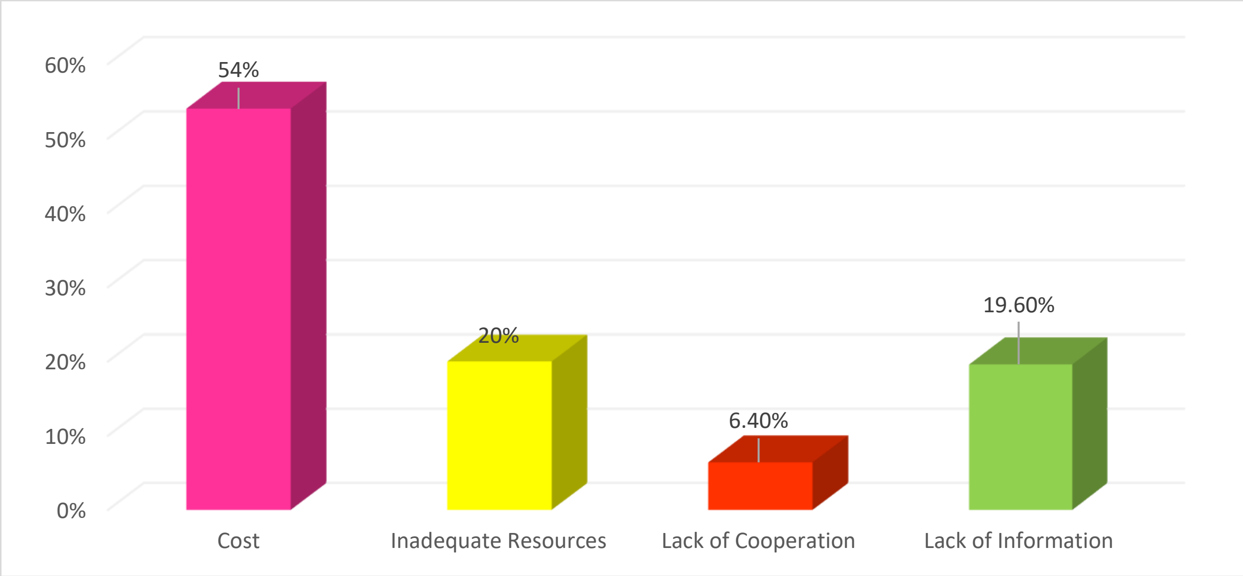

Figure 2: Challenges Organizations Face When Installing Transport Management Systems

The results above show the responses to an open-ended question where the researcher sought to determine challenges that organizations face when installing Transport Management Systems in their Supply Chain systems. Majority of the respondents (54%) affirmed that cost was a major bottleneck, followed by inadequate resources at (20%). 19.6% of respondents indicated that Lack of Information concerning Transport Management Systems was a challenge. Lastly 6.4% of respondents indicated that lack of cooperation impeded implementation of Transport Management Systems.

4.3.2 Diagnostic Tests

In this study, the following Diagnostic tests were employed: Multi-Collinearity, Auto-correlation and Normality tests.

4.3.2.1 Multi-Collinearity Tests

Table 5: Test for Multi - Collinearity

	Collinearity Statistics	
Model Factors	**Tolerance**	**VIF**
(Constant)		
Transport Management Systems	.907	1.103

Multi-collinearity tests are measured using the Variance Inflation Factor, and tolerance statistics. Generally, a Variance Inflation Factor of above 4 and tolerance statistic of below 0.25 indicates that multi - collinearity might exist, and further investigation is required. When Variance Inflation Factor is higher than 10 and tolerance statistic is lower than 0.1, there is significant multi - collinearity that needs to be corrected to avoid misleading results (Shrestha N, 2020). According to the Multi – collinearity test results, the Variance Inflation Factor for independent variable which is: Transport Management Systems, versus the dependent variable which is; Supply Chain Performance is 1.103. The tolerance statistic for the variable was found to be 0.907, meaning that the tolerance statistic was above 0.25, this indicates that there is no multi-collinearity between the variables.

4.3.2.2 Auto – Correlation Tests

Table 6: Test for Auto - Correlation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.890	0 .791	0 .479	.02702	1.640

The results in the table above showed that the Durbin – Watson statistic was 1.640. According to Dhamnetiya et al.(2022), The rule of the thumb is that the Durbin-Watson statistic ranges from 0 to 4. Values closer to 2 suggest weak positive autocorrelation, meaning that the main patterns in the data have been captured and the regression model is reliable values closer to 0 suggest strong positive autocorrelation which means that the regression model has missed trends in the data and values close to 4 indicate negative autocorrelation meaning that there could be over-adjustments or instability in the regression model. From the results above, the Durbin-Watson test statistic is 1.640 which implies weak positive autocorrelation, hence it does not have a statistically significant effect on the model estimation and prediction.

4.3.2.3 Normality Tests

Normality Test for Transport Management Systems versus Supply Chain Performance

Table 7: Test of Normality

		Kolmogorov-Smirnov			**Shapiro-Wilk**		
Transport Management Systems		**Statistic**	**df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Supply Chain Performance	24.00	0.260	2	.			
	25.00	0.328	20	0.000	0.811	20	0.001
	26.00	0.303	9	0.017	0.712	9	0.002
	27.00	0.229	9	0.190	0.826	9	0.040
	28.00	0.237	5	0.200	0.961	5	0.814
	29.00	0.206	21	0.020	0.848	21	0.004
	30.00	0.527	214	0.000	0.277	214	0.000

Normality tests were carried out using the Kolmogrov – Smirnov and Shapiro – Wilk tests. In both tests, the rule of the thumb states that if p value (sig.) is less than 0.05, then the data is not normally distributed. Using the Kolmogrov – Smirnov test for values 25.00, 26.00, 29.00, and 30.00, the p-values are less than 0.05, indicating these subsets are not normally distributed. For 27.00 and 28.00, the p-values are greater than 0.05, indicating these subsets are likely normally distributed. In the Shapiro-Wilk test, the p values of 25.00, 26.00, 27.00, and 29.00 are less than 0.05 indicating a non – normal distribution. For 28.00, the p-value is 0.814, which is greater than 0.05, indicating this subset is normally distributed. In conclusion, much of the subsets (25.00, 26.00, 29.00, and 30.00) have p-values less than 0.05 in both the Kolmogorov-Smirnov and Shapiro-Wilk tests, suggesting that the data is not normally distributed. The subset for (28.00) is likely to be normally distributed on the basis of the results from both tests.

International Journal of Supply Chain and Logistics
ISSN 2520-3983 (Online)
Vol. 9, Issue No.7, pp 73 - 92, 2025
www.carijournals.org

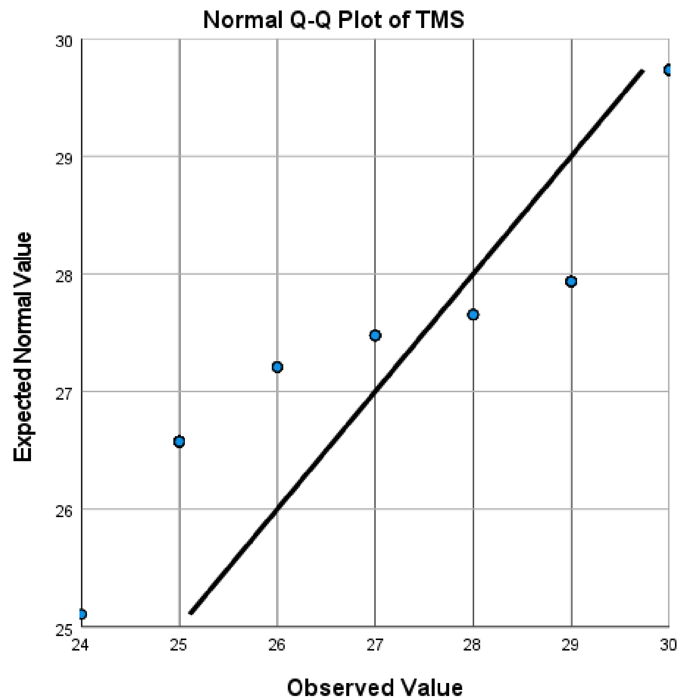

Figure 3: Normal Q-Q Plot of TMS

The Q-Q plot also shows deviations from the expected normal distribution, further supporting the conclusion that the data is not normally distributed, especially as the values diverge from the line, which would indicate a perfect normal distribution. In light of the above findings, the researcher will reject the null hypothesis, to indicate that the sub-set is not normally distributed.

4.4 Inferential Analysis

Inferential analysis takes data from a sample and makes inferences about the larger population from which the sample was drawn (Shrestha, 2020). The most common methodologies in inferential analysis are: hypothesis tests, confidence intervals, correlation analysis and regression analysis. Using correlation analysis, the study will demonstrate the relationship between Transport Management Systems and Supply Chain Performance.

4.4.1 Correlational Analysis

According to Bhushan & Alok (2019), Pearson product-moment correlation coefficient is a measure of the strength of a linear association between two variables and is symbolized by *r*. Additionally, a Pearson product-moment correlation attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, *r*, indicates how far away all these data points are to this line of best fit that is, how well the data points fit this new model or line of best fit.

Correlation values that lie between +0.50 and 1, suggest a positive Correlation, values that lie between +0.30 and +0.49 suggest a moderate correlation, a value of below +0.29 suggests a weak Correlation while a value of 0 suggests that there is no Correlation. A p value of less than 0.05 implies a significant relationship between the variables, while a p value of less than 0.01 implies a high significant relationship between variables, (Bhushan & Alok, 2019). Below are correlation results for the variables

4.4.1.1 Correlation Results for Transport Management Systems versus Supply Chain Performance

Table 8: Correlation Analysis

		Transport Management Systems	Supply Chain Performance
TMS	Pearson Correlation	1	0.610
	Sig. (2-tailed)		.000
	N	280	280
SCP	Pearson Correlation	0.610	1
	Sig. (2-tailed)	.000	
	N	280	280

The correlation coefficient between Transport Management Systems and Supply Chain Performance is r=0.610, indicating a positive correlation. This suggests that implementing Transport Management Systems leads to an improvement in Supply Chain Performance. The statistical significance which is denoted by a p value, is 0.000 which is less than 0.001, implying that correlation between Transport Management Systems and Supply Chain Performance is highly significant, meaning that chances of this correlation becoming a random observation are extremely low. This mean that there is strong evidence that the relationship is real, hence one can conclude that there is a connection between uptake of Transport Management Systems and improved Supply Chain Performance.

The results of this relationship concur with a study done by (Matuga & Kenyatta, 2022), who observed that there is a significant relationship between Transport Management Systems and performance of a firm. In his study, the regression and correlation results divulged a statistically significant positive linear relationship effect between transport management and organization’s performance of Kenya’s tea subsector industry, which is linked to firm profit margins, market share index, efficiency and effectiveness. A study done by (More et al., 2022), indicated that one of the ways that Supply Chains would be improved is by upgrading Transport Management operations, through installing Transport Management Systems. In his study, regression and correlation results disclosed a significantly positive relationship between implementation of Transport Management Systems and performance of Supply Chains.

4.4.2 Regression Analysis

The study analyzed how Transport Management Systems influenced Supply Chain Performance of Tea Factories in Meru County. Using Model Summary, Linear regression analysis and Analysis of Variance (ANOVA), the effect of Transport Management Systems on Supply Chain Performance was measured. The relevant results are indicated as follows:

$Y = \beta 0 + \beta 1X1 + \varepsilon$ ……………………………… where:

$\beta 0$ = Constant

Y = Supply Chain Performance (Dependent Variable)

X1 = Transport Management Systems

ε = Error term (the residual error of the regression)

The following are the linear regression analysis results for Transport Management Systems versus Supply Chain Performance:

Objective 1: To assess the influence of Transport Management Systems on Supply Chain Performance of Tea Factories in Meru County – Kenya.

The linear regression analysis model was carried out to establish the relationship between Transport Management System (independent variable) and Supply Chain Performance (dependent variable

Table 9: Model Summary on Transport Management Systems and Supply Chain Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.610	.372	.369	2.85000	.372	165.00	1	278	.000

a. Predictors: (Constant), Transport Management System

The R value is denoted by.610. This is the correlation between the observed and predicted values of the dependent variable (Supply Chain Performance). It indicates a moderate to strong positive

International Journal of Supply Chain and Logistics
ISSN 2520-3983 (Online)
Vol. 9, Issue No.7, pp 73 - 92, 2025

relationship. The R Square value is represented by 0.372**.** This implies that 37.2% of the variation in Supply Chain Performance is explained by the Transport Management System. The Adjusted R Square is represented by.369. This adjusts R Square for the number of predictors. It still indicates a good model fit. The Std. Error of the Estimate is 2.85000. A lower value means predictions are closer to actual values. F Change is denoted by 165.00 and Sig. F Change is .000**,** which shows that the model is statistically significant p < .001), meaning that Transport Management System significantly predicts Supply Chain Performance.

Table 10: ANOVA Results on Transport Management Systems and Supply Chain Performance

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1377.57	1	1377.57	165.00	.000
	Residual	2302.01	278	8.35		
	Total	3697.586	279			

a. Dependent Variable: Supply Chain Performance

b. Predictors: (Constant), Transport Management System

The regression sum of squares is 1377.57 and the residual sum of squares is 2320.01**.** A large regression sum compared to the residual indicates the model explains a good portion of variance. The F Value is 165.00**,** which is the ratio of model variance to error variance. A high F value with sig. = .000 confirms the model is statistically significant and the predictor adds value.

Table 11: Model Results on Transport Management Systems and Supply Chain Performance

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	20.500	1.200		17.08	.000
	Transport Management System	0.650	0.051	.610	12.85	.000

a. Dependent Variable: Supply Chain Performance

The table above shows the model significant test results for the hypothesized research model. The interpretations of the findings generated the following regression equation;

Y= 20.500 + 0.650X1

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The Constant is 20.500 which means that when the Transport Management System score is 0, the expected value of Supply Chain Performance is 20.5. The unstandardized Coefficient for Transport Management System is B = 0.650. For every one-unit increase in the Transport Management System score, Supply Chain Performance increases by 0.650 units a positive and meaningful impact. Standardized beta .610 indicates the strength of the relationship in standardized units which is quite strong. When t is 12.85, the significance is .000. This indicates that the predictor is statistically significant and makes a substantial contribution to the model.

4.4.3 Testing of Hypotheses

Hypothesis tests are used to assess whether a difference between two samples represents a real difference between the populations from which the samples were taken (Shakir et,al, 2022). A null hypothesis of 'no difference' is taken as a starting point, and the researcher calculates the probability that both sets of data came from the same population. This probability is expressed as a p-value. When the null hypothesis is false, p-values tend to be smaller than 0.05. When the null hypothesis is true, the p- values are bigger than 0.05 (Shakir et,al, 2022).

The p value of Transport Management Systems was 0.000, which is less than 0.005, hence the null hypothesis of H_{01} that represents TMS was rejected, concluding that TMS have a statistically significant influence on Supply Chain Performance. From the above observations, one can infer that Transport Management Systems significantly influence Supply Chain Performance.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The research findings are summarized and presented in this section. The summary captures both the descriptive and inferential findings in line with the objectives of the study.

5.1.2 Transport Management Systems and Supply Chain Performance

Respondents agreed that Transport Management Systems would reduce lead time, improve sales, ease transport operations, optimize transport operations, ease visibility of operations and curb unnecessary costs. Correlation results indicated that the relationship between Transport Management Systems and Supply Chain Performance, was statistically significant with a p-value of .000, which means that it is less than 0.001. This indicated a strong evidence against the null hypothesis of independence, hence suggesting a strong association between the two variables. These findings agree with those of (Sapate et al., 2022), whose study involved Transport Management Systems and their impact on the Supply Chains of Manufacturing firms. The findings show a positive relationship between Transport Management Systems and Supply Chain Performance.

5.2 Conclusions

The study surmised that Transport Management Systems highly influenced Supply Chain Performance by optimizing transport operations and easing their visibility. Transport Management Systems helped curb unnecessary costs that are caused by delays and insecurity, as it makes it easier to track vehicles. Reduction of lead times and improvement of sales are other advantages that were found to accompany digitalization of Transport Systems. The overall observations indicate that Transport Management Systems strongly influence Supply Chain Performance.

5.3 Recommendations

The following are the recommendations made by the study to address the problems identified. The first recommendation was that Tea Factories in Meru County, should set up Research and Development departments which would be responsible in coming up with innovative ideas on how to improve operations, make profit and offer quality products to consumers. Another recommendation would be for Factories to set up a Fund, whose money shall be applied in research and development. This is in line with section 54 of the provisions of the Tea Act that was gazzetted in 2020, that recommend establishment of Tea Fund for the purposes of research and development and Income or Price stabilization (GoK, 2020).

The second recommendation would be to form collaborations and partnerships with academic institutions and tech firms in order to develop state-of-the-art technologies to address challenges in the Tea sector. Some of these Technologies can be used to solve Logistical challenges in Tea Factories. The report compiled by (GoK, 2020), encourages establishment of agricultural innovation hubs to support research into Technological solutions that can be applied in the Tea Industry.

The third recommendation would be to introduce Block Chain Technology for Supply Chain Transparency. The use of Block Chain Technologies can provide real-time tracking of Tea from farms to the market, which promotes quality control and transparency concerning the production process. Moreover, Block chain Technology helps reduce fraud and manipulation in Tea Auctions, and provides accurate data on sales, pricing and quality (Mong & Muturi, 2019).

5.4 Suggestions for further Research

The following are the suggestions that were put forth for further research: Examine the utilization of digital platforms that expedite communication between Tea Farmers and Factories, like; mobile apps for scheduling deliveries, tracking payments and sharing agricultural information, Assessing the influence of Digital Logistics Systems on empowering smallholder Tea farmers by building on access to markets, fair pricing and timely logistics and how implementation of Transport Management Systems in Tea Factories affect the competitiveness of Meru's Tea in international markets.

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