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LOGISTICS AUTOMATION DRIVERS AND OPERATIONAL PERFORMANCE OF TEA PROCESSING FIRMS IN KISII COUNTY, KENYA

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ABSTRACT

Significance: *The contribution of logistics management to gaining a competitive advantage is embedded in the concept of relative performance, which can be measured by asking the company to compare its performance with that of its competitors.*

Objectives: *The general objective of the study was to ascertain the relationship between logistics automation drivers and operational performance of tea processing firms in Kisii County. This research specifically focused on the following objectives: to establish the most common logistics automation drivers among tea processing firms; to determine the logistics automation applications commonly used by tea processing firms; to establish the challenges in the implementation of logistics automation applications among tea processing firms; and to establish the influence of logistics automation drivers on operational performance of tea processing firms.*

Design*: The researcher adopted both qualitative and quantitative research designs by surveying the relationship between logistics automation drivers and operational performance of tea processing firms in Kisii County; hence, it is descriptive and explores the relationship between logistics automation drivers and operational performance towards success.*

Finding*: Firstly it can be concluded that the greatest drivers in logistics automation are the need to improve product quality, employees' safety, labour productivity and reducing the lead time. Secondly from the research findings, it was concluded that the tea processing firms are well equipped with the logistics automation applications which are aimed at improving operational performance. Thirdly from the research findings it could be concluded that logistics automation is not a major challenge hence the need to check on its impact on operational performance. Lastly it could be concluded that there is a very strong and significant relationship between logistics automation drivers and operational performance among tea processing firms.*

Keywords: *drivers of logistics automation, logistics automation, operational performance*

INTRODUCTION

Logistics automation basically focuses on inbound logistics which concentrates on purchasing and arranging inbound movement of materials, parts and or finished inventory from suppliers to manufacturing or assembly

plants, warehouses or retail stores. In most manufacturing firms, there is a correlation between logistics automation and organizational performance which implies that the use of logistics automation applications can increases firms competitiveness (Laugen et al., 2005).

In Africa, many public sector organizations view operational performance as an add-on or an approach that add value to logistics. Sustainable solutions can often cost less over the whole life of the purchase (Lysons and Farrington, 2010). Poor planning has been a major constraint in successful Operational Performance as a result of time and cost over-runs (Chandra, 2008; Oladipo, 2008). The Kenya Government has always been committed to developing a mixed economy where both public and private sector companies are present (Kenya Government, Development Plan 1989- 1993). Public sector participation in manufacturing is much smaller than the private sector and is still decreasing due to government's change of policy; the emphasis is now being given to privatization of the industrial sector.

According to Owour (2011); small scale tea holders under the control of Kenya Tea Development Agency produced up to 60% of Kenya tea over the previous decade. Currently Kenya is the leading tea producer which accounts for 14% of the world's tea production and the huge exporter of tea which accounts to 23% of the exports. Through KTDA Kenya's tea industry has successfully continuously improved in terms of tea quality through upgrading and modernization of production systems and also use of modern agronomic recommendation. It has also lead to achievement of effectiveness in terms of cost and enabling frequent review of payments of farmers upwards irrespective of stagnation of the world tea prices. In the year 2010 crop KTDA paid farmers best prices per kilo of leaf which was 75% of the revenue from leaf went compared to all the tea producers.

Kisii Region is one of the key tea producing counties in Kenya where it produces 77,000 metric tons per year. Irrespective of the wideness and high production, the region is being served by only twelve tea processing firms and they include; Sang'anyi, Tombe, Gianchore, Nyansiongo, Kebirigo, Nyankoba, Rianyamwamu, Itumbe, Nyamache, Ogembo, Eberege and Kiamokama. Because of the small number of tea processing firms in Kisii region this leads to wider area of operation of the firms hence leading to many constraints in tea processing which in turn leads to high percentage of wastage until the products reaches the final consumer (KTDA website; factories-region/region 6-kisii highlands).

On the issue of marketing the processed tea is auctioned in Mombasa and this leads to long supply chains or value chains. It is because of this that the tea processing firms need to put in place lean manufacturing practices which in turn will lead to good performance in manufacturing firms. This will equally lead to high customer satisfaction both the internal and external customers (KTDA website; factories-region/region 6-kisii highlands).

The study focused on the seven tea processing firms in Kisii County namely: Gianchore, Rianyamwamu, Itumbe, Nyamache, Ogembo, Eberege and Kiamokama

STATEMENT OF THE PROBLEM

Tea processing in Kisii County is faced with many challenges one of them being that high cost of production which results from unnecessary activities within the value chain and also inability to identify waste within the process and eliminate. This starts right from the buying centers where tea is delivered by farmers, delivery of tea to the factory, during processing and marketing of the processed tea products (Towett, 2012). Failure to focus on the tea value chain logistics has led to operational underperformance for most tea processing firms,

especially at this digital era when logistics automation is the only frontier in the improvement of operational performance. From the practioners perspective, the drivers of logistics automation and their influence on firm operational performance remains scanty from the Kenyan perspective.

The first research gap is that most past studies have not addressed the drivers of logistics automation especially by relating them with overall operation performance of the value addition firms especially in tea processing. There is need for broad focus on operational performance as opposed to past narrow relationships between logistics automation and cost management. In a survey by the Material Handling Industry of America (2011) more than 90 % of the respondents using automation in their internal logistics system said that it is an asset to their operations and creates a competitive advantage. Schulze and Wüllner (2006) conclude that it is most likely that automation is a key point in the future development of internal logistics. Looking back, automation has also, since the 1960s, played a key role in the development of the internal logistics area (Kartnig et al., 2012), and the sales of automated equipment for use in internal logistics have been growing steadily during the last decades (Baker and Halim, 2007; Cruz Di Palma and Basaldúa, 2009; Echelmeyer et al., 2008). The outlook for the coming years is continued growth in automated materials handling equipment orders (Material Handling Industry of America, 2010). In a large-scale survey on investment plans for materials handling operations, 74 % of the respondents indicated that they are planning or considering automation (Material Handling Industry of America, 2012).Still, despite the importance of automating internal logistics, it has previously mostly been viewed only from a cost perspective (Gattorna, 2012; Mentzer and Konrad, 1991; Michalos et al., 2010; Olavarrieta and Ellinger, 1997), and its influence on the overall business performance and its potential to create value and increase operational performance are not fully recognized (Rutner and Langley Jr., 2000). Instead, it is traditionally seen as only a support function, or a function among others in the firm (Kihlén, 2007). Hence the needs to test whether logistics automation drivers have any effect on the performance of a value-addition supply chain in the Kenyan context.

Secondly, most of the previous studies on the drivers of logistics automation are case studies hence the need for a survey research design using economic approaches of performance measurement. Logistics research is influenced by economic and behavioral approaches. The economic approaches focus its attention on cost minimization and profit maximization while behavioral approaches focuses on psychological and sociological aspects (Mentzer and Kahn, 1995). Samuel (1997) compared dominating paradigms and methods used in three logistics/SCM journals. Findings from the existing reviews are: direct observation research methods (case study and action research) are less popular; researchers are mainly using people's perception (survey and interview) or artificial methods (simulation and mathematical modeling) for research in the discipline; surveys, interviews, modeling are popular methods of research in logistics; and descriptive statistics is usually used for analysis of empirical studies data. The proposed study will not be a case study and will use interviews to ascertain the drivers of logistics automation among tea processing firms in Kisii County.

Thirdly, very few studies have linked drivers of logistics automation with operational efficiency and effectiveness. Most of them have just linked logistics without automation especially the drivers to overall firm performance without focusing operational performance. The role that logistics plays in a company's overall performance, profitability and competitiveness is large. In fact it plays a major role in creating value and determining the overall corporate response to market opportunities (Gattorna and Walters, 1996; Rutner and Langley Jr., 2000; Stank et al., 2003). Christopher (1997) even concludes that it is supply chains that compete, not companies. Logistics, being an important part of the supply chain, should thus be accorded a high strategic priority (Stock et al., 1998; Stock et al., 2000) since it represents a source of sustainable competitive advantages

(Mentzer and Williams, 2001; Porter, 2004a; Stalk et al., 1992; Stock and Lambert, 2001; Yazdanparast et al., 2010).

Lastly, logistics automation especially the drivers is a current research issues whose influence on operational issues has not been attested. Due to the large impact of the internal logistics system on both resource usage and cost, there are large potential benefits of improving this system. A well-designed and automated logistics system increases the efficiency of the organization in which it is embedded (Aized, 2010; Hassan, 2010; Mattsson and Jonsson, 2003; Rembold and Tanchoco, 1994; Öjmertz, 1998), which also signifies the importance of focusing on and continuously improving this system to enhance its operational performance. This study sets out to attest the influence of logistics automation drivers on the operational performance of tea processing firms in Kisii County.

Indeed tea factories in Kisii County to some given extent have automated their processes especially their internal logistics, but no effort has been made to empirically test what the drivers or what is the motivation for such investments in logistics automation. This study will seek to address the above knowledge gap especially by assessing the drivers of logistics automation among tea processing firms in Kisii county; there is need to overcome the limitations of case studies since most of the previous studies in logistics automation are case studies hence the need for a survey research design using economic approaches of what are the key drivers of such an investment; and moreover this study uses a broad focus on drivers as opposed to the adoption process which can be failure if the divers are not clear or well established before applying resources in the implementation or adoption process.

OBJECTIVES OF THE STUDY

This research specifically focused on the following objectives:

i. To establish the most common logistics automation drivers among tea processing firms in Kisii County;

ii. To determine the logistics automation applications commonly used by tea processing firms in Kisii County;

iii. To establish the challenges in the implementation of logistics automation applications among tea processing firms in Kisii County; and

iv. To establish the influence of logistics automation drivers on operational performance of tea processing firms in Kisii County

RESEARCH METHODOLOGY

The researcher adopted both qualitative and quantitative research designs by surveying the relationship between logistics automation drivers and operational performance of tea processing firms in Kisii County; hence, it is descriptive and explores the relationship between logistics automation drivers and operational performance towards success. The study area was strictly the tea processing firms in Kisii County. Relevant data on the training needs was gathered using a structured questionnaire and focused group interviews. The target population for this study was thirty five (35) respondents, five (5) respondents from each of the seven (7) tea processing factories in Kisii County. The questionnaires were inspected for completeness, edited, coded and the data keyed into Statistical Package for Social Sciences (SPSS) package. Descriptive statistics such frequency and percentages are used in the analysis. In addition cross tabulations were used to check if there

exists any difference. Content analysis was used to analyse the focused group discussions outcomes and open-ended questions.

RESEARCH FINDINGS AND CONCLUSION

Logistics Automation Drivers for Tea Processing Firms in Kisii County

There are four drivers that can be used to justify the firm's investment decisions in logistics automation. The following subsections tests the extent to which the four drivers have influenced the tea processing firm's investment decisions in logistics automation.

The Need To Improve Labour Productivity

One of the logistics automation drivers is the need to improve labour productivity. The respondents were asked to indicate the extent to which their tea processing firms have been motivated by a number of factors in an effort to improve labour productivity through their investment decisions in logistics automation (using scale where 1 = Very Small Extent, 2 = Small Extent, 3 = Moderate Extent, 4 = Great Extent, 5 = Very Great Extent). The results are as in table 1 below.

Table 1 The Need to Improve Labour Productivity

The Need To Improve Labour Productivity	Descriptive Statistics		Rank
	Mean	Std Dev.	
The tea processing firm has automated its logistics due to the need to reduce the costs of working overtime.	3.8437	.80760	Great Extent
The tea processing firm has automated its logistics due to the need to reduce the costs of rework.	3.8437	.80760	
The tea processing firm has automated its logistics due to the need to reduce the high cost of needed resources and material.	3.8125	1.06066	
The tea processing firm has automated its logistics due to the need to increase labour productivity;	3.7812	.42001	
The tea processing firm has automated its logistics due to the need reduce labour cost;	3.7812	.42001	
The tea processing firm has automated its logistics due to the need to reduce the cost of the wasted materials on site.	3.7500	.71842	
The tea processing firm has automated its logistics due to the need reduce or eliminate routine manual and clerical tasks;	3.7188	.77186	
The tea processing firm has automated its logistics due to the need mitigate the effects of labour shortages;	3.4063	.79755	Moderate Extent
The tea processing firm has automated its logistics due to the need to deal with lack of experience in its manpower.	3.3750	1.31370	
The tea processing firm has automated its logistics due to the need to deal with personal problems in its manpower.	3.3750	.97551	
The tea processing firm has automated its logistics due to the need to deal with absenteeism in its manpower.	3.2188	.75067	
The tea processing firm has automated its logistics due to the need to deal with misunderstanding among laborers.	3.2187	1.62112	
The tea processing firm has automated its logistics due to the need to deal with lack of labour motivation.	3.1563	1.43930	

The tea processing firm has automated its logistics due to the need to deal with lack of competition between the laborers.	2.9688	1.37921	
The tea processing firm has automated its logistics due to the need to deal with disloyalty.	2.9062	1.02735	
The tea processing firm has automated its logistics in an effort to deal with the material shortage.	2.2500	1.34404	Small Extent
Average Mean	**3.400388**		**Moderate Extent**

From the findings in table 1 above, to a great extent (3.84≥Mean≥3.71 and with significant standard deviation) the tea processing firms have automated their logistics due to the need to: reduce the costs of working overtime; reduce the costs of rework; reduce the high cost of needed resources and material; increase labour productivity; reduce labour cost; reduce the cost of the wasted materials on site; and reduce or eliminate routine manual and clerical tasks. These findings are in agreement with the many reasons that justify or drive automation as per Groover (2008) who had cited the drive to increase labour productivity and reduce labour cost in an effort to mitigate the effects of labour shortages.

The modest drivers (3.40≥Mean≥2.91 and with significant standard deviation) in the need to increase labour productivity include the need to deal with: lack of experience in its manpower; personal problems in its manpower; absenteeism in its manpower; misunderstanding among laborers; lack of labour motivation; lack of competition between the laborers; and disloyalty. These findings are in support of Groover (2008) empirical evidence that automation is always the best tool to deal with issues of employee absenteeism, demotivation, loyalty breaks, smoothening personality clashes and labour shortages.

The overall average mean on the need to improve labour productivity in the tea processing firm's investment decisions in logistics automation was 3.400388 meaning the need to improve labour productivity is a modest driver in logistics automation in effort to improve organizational performance.

The Need to Improve Employee Safety

The need to improve on employee safety is the second driver in the firm's investment decisions in logistics automation. The respondents were asked to indicate the extent to which the need to improve employee safety has influenced their tea processing firm's investment decisions in logistics automation and the results are as in table 2 below. This was rated on a five likert scale where 1 = Very Small Extent, 2 = Small Extent, 3 = Moderate Extent, 4 = Great Extent, 5 = Very Great Extent.

Table 2 The Need to Improve Employee Safety

The Need To Improve Employee Safety	**Descriptive Statistics**		**Ranking**
	Mean	**Std Dev.**	
Through logistics automation, the tea processing firms seeks to frequent communications about safety issues in at the workplace.	4.8125	.39656	Very Great Extent
Through logistics automation, the tea processing firms seeks to ensure safety of workers is a high priority for management.	4.6250	.49187	
Through logistics automation, the tea processing firms seeks to ensure formal checks (inspections) are regularly done to see if workers are following safety rules.	4.6250	.49187	

Through logistics automation, the tea processing firms recognizes employee safety as important as the quality of the work and getting the work done on time.	4.5937	.49899	
Through logistics automation, the tea processing firms seeks to ensure no major shortcuts are taken when worker safety is involved.	4.5937	.49899	
Through logistics automation, the tea processing firms seeks to ensure management acts quickly when a safety concern or problem is raised.	4.4063	.49899	Great Extent
Through logistics automation, the tea processing firms seeks to ensure different departments work together to improve safety.	4.4063	.49899	
Through logistics automation, the tea processing firms seeks to ensure the safest possible conditions for its employees.	4.3750	.49187	
Through logistics automation, the tea processing firms seeks to ensure there is a system of rules about how to work safely.	4.1563	.36890	
Through logistics automation, the tea processing firms seeks to ensure workers who act safety receive positive recognition (feedback).	3.5000	.76200	
Through logistics automation, the tea processing firms seeks to reduce the investment in a lot of time and money in safety training for workers.	3.3438	.48256	
Average Mean	**4.312509**		**Great Extent**

From the findings in table 2 above, to a very great extent (4.8125≥Mean≥ 4.5937and with significant standard deviation) through logistics automation, the tea processing firms seeks to: frequent communications about safety issues in at the workplace; ensure safety of workers is a high priority for management; ensure formal checks (inspections) are regularly done to see if workers are following safety rules; ensure quality of the work and getting the work done on time; and ensure no major shortcuts are taken when worker safety is involved. These findings are in line with the conclusion drawn by Aized, (2010) and Lumsden, (2012) which indicated that worker safety can be used for improving internal logistics activities since it is a true driver of any internal logistics automation aimed at improving operational efficiency.

The greatest motivating factors (4.41≥Mean≥3.34 and with significant standard deviation) through logistics automation, the tea processing firms seeks to: ensure management acts quickly when a safety concern or problem is raised; ensure different departments work together to improve safety; ensure the safest possible conditions for its employees; ensure there is a system of rules about how to work safely; ensure workers who act safety receive positive recognition (feedback); and reduce the investment in a lot of time and money in safety training for workers. This results confirms that Tompkins et al., (2010) study which indicated that the greatest safety drivers in logistics automation are the need to improve the overall working environment, reduction in the training costs and worker safety drills for operational efficiency.

The overall average mean on the need to improve employees safety in the tea processing firm's investment decisions in logistics automation was **4.312509** meaning the need to improve employees safety is a great driver in logistics automation in effort to improve organizational performance.

The Need to Improve Product Quality

The need to improve on employee safety is the third driver in the firm's investment decisions in logistics automation. The respondents were asked to indicate the extent to which the need to improve product quality has influenced their tea processing firm's investment decisions in logistics automation and the results are as in table 3 below. This was rated on a five likert scale where 1 = Very Small Extent, 2 = Small Extent, 3 = Moderate Extent, 4 = Great Extent, 5 = Very Great Extent.

Table 3 The Need to Improve Product Quality

The Need To Improve Product Quality	**Descriptive Statistics**		**Ranking**
	Mean	**Std Dev.**	
Through logistics automation, the tea processing firms seeks to reduce the number of delivered defect quantities.	4.8125	.39656	*Very Great Extent*
Through logistics automation, the tea processing firms seeks to improve product quality;	4.6563	.48256	
Through logistics automation, the tea processing firms seeks to reduce the complexity of delivered product.	4.4063	.79755	*Great Extent*
Through logistics automation, the tea processing firms seeks to achieve high levels of responsiveness (turnaround time) to users.	4.3750	.49187	
The tea processing firm reduce lead time;	4.1875	.39656	
Through logistics automation, the tea processing firms seeks to reduce product volatility.	4.1563	.36890	
Through logistics automation, the tea processing firms seeks to improve its Defect removal efficiency.	4.1563	.36890	
The tea processing firm avoid the high cost of not automating.	4.0313	.64680	
The tea processing firm accomplish processes that cannot be done manually;	3.9063	.89296	
Average Mean	**4.298644**		***Great Extent***

From the findings in table 3 above, to a very great extent (4.81≥Mean≥ 4.66 and with significant standard deviation) through logistics automation, the tea processing firms seeks to reduce the number of delivered defect quantities as they seek to improve product quality. The greatest motivating factors (4.41≥Mean≥3.91 and with significant standard deviation) through logistics automation, the tea processing firms seeks to: reduce the complexity of delivered product; achieve high levels of responsiveness (turnaround time) to users; reduce lead time; reduce product volatility; improve its Defect removal efficiency; avoid the high cost of not automating; and to accomplish processes that cannot be done manually. These findings are in line with findings from a study by Flynn et al. (2010) which indicated that product quality requires automation for proper control of standards and standardized output which can reduce defects and improve overall product quality.

The overall average mean on the need to improve product quality in the tea processing firm's investment decisions in logistics automation was **4.298644** meaning the need to improve product quality is a great driver in logistics automation in effort to improve organizational performance.

The Need to Reduce Lead Time

The need to reduce the lead time for perishable raw material input can be a real driver in logistics automation. The respondents were asked to provide primary and secondary data as given in table 4 a & b below.

Table 4 a The Need to reduce lead time

The Need To reduce lead time	Descriptive Statistics	
	Mean	Std Dev.
The tea processing firm reduce lead time;	4.1875	.39656

Table 4 b The Need to reduce lead time

The Need To reduce lead time	Unit of Measure	2015	2016	2017
Average Lead time	Days	23	21	17

From the research findings in table 4 a & b, the need to reduce the lead time is a greater drive (Mean >4.2) in the tea processing firm's motivation to invest in logistics automation. The achievement of reducing the lead time from 23 days to 17 days shows really reduction by 6 days in the overall lead time is a driver in logistics automation as cited by Lumsden, (2012).

Logistics Automation Applications

There are a number of logistics automation applications that can be used to enhance the firm's operational performance. The respondents were asked to indicate the extent to which their tea processing firms had implemented a number of applications in relation to the following logistics automation applications in an effort to improve its performance. This was on a five likert scale where 1 = Not Equipped, 2 = Equipped, 3 = Very Equipped, 4 = Highly Equipped, 5 = Very Highly Equipped. The findings are as in table 5 below.

Table 5 The Logistics Automation Applications

Logistics Automation Applications	Descriptive Statistics		Rating
	Mean	Std Dev.	
Screening and/or sorting systems.	3.2812	.99139	Very Equipped
Conveyor belts and conveyorised sorting systems;	2.9063	1.11758	
Automated loading and unloading systems;	2.8750	.90696	
Moving decks;	2.7812	1.43087	
Automatic fork-lift trucks for mechanised handling;	2.6875	.96512	
Mechanised palletizing;	2.6250	1.28891	
Automated storage and retrieval systems (AS/RS);	2.5000	.76200	
Linear actuators;	2.4688	1.26960	Equipped
Automated guided vehicles (AGVs);	2.3125	.96512	
Carousels (various types);	2.2813	1.19770	
Item-picking devices;	2.0625	1.36636	
Lift and turn tables/aids;	2.0625	1.36636	
Industrial robots/robotics (for numerous applications);	2.0000	1.52400	
Average Mean	**2.526446**		**Equipped**

From the findings on table 5, the tea processing firms are well equipped (Mean >3.5) with: Screening and/or sorting systems; Conveyor belts and conveyorised sorting systems; Automated loading and unloading systems; Moving decks; Automatic fork-lift trucks for mechanised handling; Mechanised palletizing; and Automated

storage and retrieval systems (AS/RS). Further, the following applications are currently in use (Men>2.0) particularly the item-picking devices and turn tables in the fermentation of brown or crashed tea.

The overall average mean on the implementation of logistics automation application was **2.526446** meaning the tea processing firms are well equipped with the logistics automation applications which are aimed at improving operational performance. These findings are in support of the findings by Tompkins et al., (2010) which cited that the most commonly used applications in logistics automation are the conveyor belts and conveyorised sorting systems with automated loading and unloading systems

The Challenges in the Implementation of Logistics Automation Applications among Tea Processing Firms in Kisii County

The automation of the logistics function requires strong drive or motivation with huge investment in the automation applications. The motivation and investment in the logistics automation can be faced by a number of challenges. The respondents were asked to indicate the extent to which their tea processing firm experienced a number of challenges in the implementation of the logistics automation applications and the results are as in table 6 below. This was on a five likert scale where 1 = Very Small Extent, 2 = Small Extent, 3 = Moderate Extent, 4 = Great Extent, 5 = Very Great Extent.

Table 6 The Logistics Automation Challenges

Logistics Automation Challenges	**Descriptive Statistics**	
	Mean	**Std Dev.**
The tea processing firm is experiencing high cost of training;	3.9063	.64053
The tea processing firm is experiencing high operational costs;	3.0938	.77707
The tea processing firm is avoiding the high cost of not automating.	2.8437	1.22104
The tea processing firm is experiencing rapid change in technology and obsolescence	2.7813	.94132
The tea processing firm is experiencing system failures;	2.6563	1.09572
The tea processing firm is experiencing employee resistance to change;	2.6563	1.09572
The tea processing firm is experiencing lack of top management support;	1.6562	1.09572
Average Mean	**2.799129**	

From the findings in table 6 above, in an effort to automate the logistics function the tea processing firms are experiencing: high cost of training; high operational costs; rapid change in technology and obsolescence; system failures; employee resistance to change; and lack of top management support. These findings are in line with observations made by Material Handling Industry of America, (2011); and Baker and Halim, (2007) that there are difficulties and potential challenges of using automation especially the high cost of equipment, the financial justification of such logistics automation and reliability of equipment.

The overall mean of the challenges facing the tea processing forms logistics automation is at 2.80 meaning the logistics automation is not a major challenge hence the need to check on its impact on operational performance.

Operational Performance of Tea Processing Firms

The motivation to invest in logistics automation is to seek improvements in operational performance. The respondents were asked to indicate the extent to which the logistics automation had led to the improvement of the following aspects of operational performance on a five likert scale where 1 = Very Small Extent, 2 = Small

Extent, 3 = Moderate Extent, 4 = Great Extent, 5 = Very Great Extent. The results are as in table 7 and Table 8 below.

Table 7: Operational Performance Attributes

Operational Performance	**Descriptive Statistics**		**Average Mean**
	Mean	**Std Dev.**	
Quality			4.16666667
Improved Product quality	4.4375	.50402	
Enhanced variability in products	4.0625	1.54372	
Attainment of the customers' specifications	4.0000	.00000	
Cost			3.90623333
Enhanced productivity	4.3437	.48256	
Reduced production costs	3.7813	.70639	
Reduced inventory	3.5937	.49899	
Flexibility			3.3175
Ability to adjust capacity rapidly within a short period	4.0000	.00000	
Ability to make adjustments in the various production methods	3.8125	.39656	
Production in new products	2.9375	1.18967	
Ability to redesign the products	2.5200	1.78232	
Delivery			4.36456667
Reliability in delivery	4.8125	.39656	
Delivery is on time even under pressure	4.2812	.77186	
Reduced delivery time is enhanced	4.0000	.00000	
Others			3.83484286
Improved labor productivity	4.1563	.36890	
Enhanced customer service	4.0000	.00000	
Reduction in inventory paperwork	3.9688	.59484	
Facilitates standardization of inventory movements	3.9687	.59484	
Improved cycle counting	3.8125	.39656	
More efficient use of available warehouse space	3.7813	.70639	
Faster inventory turns	3.1563	.36890	
Overall Composite Average			3.917962

From the research findings above, the operational performance of the tea processing firms is characterized with: enhanced product quality (Mean = 4.12, Great Extent); reduced production costs (Mean = 3.9, Great Extent); enhanced operations flexibility (Mean = 3.32, Medium Extent); reliability in delivery (Mean = 4.4, Great Extent); enhanced customer service (Mean = 3.83, Great Extent). The overall composite average mean on the attributes of operational performance is at 3.917962 meaning the automation of the logistics function has led to 78.35924% (3.92/5*100) improvement in the tea processing firms operational performance. These finding are in agreement with Aized, (2010) and Hassan, (2010) observation that a well-designed and automated logistics system increases the efficiency of the organization in which its system is embedded to enhance its operational performance.

The attributes are not a good measure of operational performance. The secondary data was collected to test the relationship between logistics automation drivers and operational performance. The computation of the composite index on operational performance was computed as follows in table 8.

Table 8: Composite Operational Performance Index

Operational Performance Measure	**Unit of Measure**	**Weight**	**Achievements**			**Weighted Score**			**Average**
			2015	**2016**	**2017**	**2015**	**2016**	**2017**	
Customer Satisfaction Score	%	0.11111	60	70	75	6.6666	7.7777	8.33325	7.592517
Employee Satisfaction Score	%	0.11111	70	73	80	7.7777	8.11103	8.8888	8.259177
Productivity level	%	0.11111	60	63	75	6.6666	6.99993	8.33325	7.33326
New product offering	Number	0.11111	0	0	0	0	0	0	0
Return On Investment (ROI)	Ratio	0.11111	90	90	90	9.9999	9.9999	9.9999	9.9999
Days Sales Outstanding	Days	0.11111	30	30	30	3.3333	3.3333	3.3333	3.3333
Days Payable Outstanding	Days	0.11111	30	30	30	3.3333	3.3333	3.3333	3.3333
Gross Margin	Kshs.	0.11111	31.5	39.8	41	3.499965	4.422178	4.55551	4.159218
Lead time	Days	0.11111	30	30	30	3.3333	3.3333	3.3333	3.3333
							Composite Score		**47.34397**

Using weighted scores, each measure of operation al performance was given an equal weight {(9/10)/100}. Then each achievement in every year was multiplied by the weight. Then an average score was computed which was used to compute the composite performance index that could be used to compute the relationship between the drivers and operational performance. The overall score was found to be 47.34% using the quantitative measures of operational performance.

The Influence of Logistics Automation Drivers on Operational Performance of Tea Processing Firms in Kisii County

In order to establish the influence of logistics automation drivers on operational performance of tea processing firms in Kisii County, there was need to compute the mean for each questionnaire response for each logistics automation drivers against operational performance index (see Annex II). The influence of logistics automation drivers on operational performance of tea processing firms in Kisii County is presented as below:

Table 9 Model Summary for Logistics Automation Drivers on Operational Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.870a	.758	.722	1.88963	.758	21.110	4	27	.000
a. Predictors: (Constant), Lead Time, need to improve Product Quality , need to improve labour productivity , need to improve employee safety									

From the regression results in table 9 above, the relationship between logistics automation drivers and operational performance is significant model since the results are significant at the set confidence interval of 100%. The overall suitability of the model is that 72.2% of the changes in the tea processing firm's operational performance are explained by logistics automation drivers of lead time, need to improve product quality , need to improve labour productivity , need to improve employee safety.

Table 10: ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	301.511	4	75.378	21.110	.000b
	Residual	96.408	27	3.571		
	Total	397.920	31			
a. Dependent Variable: Operational Performance						
b. Predictors: (Constant), Lead Time, need to improve Product Quality , need to improve labour productivity , need to improve employee safety						

Based on analysis of variance in table 10 above, the results are significant at 100% confidence interval with four degrees of freedom with F=21.110 which is less than the calculated f critical of 75.378.

The coefficients of this predicative model aimed at addressing the relationship between logistics automation drivers and operational performance are given as in the table 11 below.

Table 11: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	188.766	16.785		11.246	.000		
	need to improve labour productivity	10.716	1.270	2.219	8.439	.000	.130	7.704
	need to improve employee safety	-106.069	11.609	-4.927	-9.137	.000	.031	32.400
	need to improve Product Quality	57.793	6.806	3.297	8.492	.000	.060	16.796
	Lead Time	13.496	1.739	1.786	7.763	.000	.169	5.901
a. Dependent Variable: Operational Performance								

From the results in table 11 above, the predictive model for the relationship between logistics automation drivers and operational performance can be given in the equation below:

Operational Performance = ***2.219 Need To Improve Labour Productivity -4.927 Need To Improve Employee Safety + 3.297 Need To Improve Product Quality + 1.786 Lead Time***

From the above model, the need to improve labour productivity, product quality and reduce lead time are positive predicators of operational performance in the logistics investment and automation while labour or employee safety is compromised with automation hence the negative coefficient.

Based on the collinearity test in table 12 below, the four drivers are distinct and mutually exclusive.

Table 12: Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	Need To Improve Labour Productivity	Need To Improve Employee Safety	Need To Improve Product Quality	Lead Time
1	1	4.941	1.000	.00	.00	.00	.00	.00
	2	.030	12.936	.00	.13	.00	.00	.00
	3	.028	13.200	.00	.02	.00	.00	.17
	4	.001	78.378	.29	.04	.00	.06	.04
	5	3.152E-005	395.961	.71	.81	1.00	.94	.78
a. Dependent Variable: Operational Performance								

Summary of the Findings

From the findings, on the demographics it is established that out of the thirty five respondents, only thirty-two (32) respondents filled the questionnaires from the seven (7) tea processing firms. This gave a response rate of 91.43%. Majority of the respondents have a college diploma (43.8%), followed by 40.6% with masters' degree while 15.6% had a bachelor's degree. This is an indication that the respondents who participated in this study were knowledgeable to understand and synthesize the issues of logistics automation drivers and operational performance. All the respondents (100.0%) have more than 4 years' experience in discharging their duties in tea processing which implies that the respondents had a good grasp of the best experience on issues of logistics automation and their profound influence in operational performance. all the key employees involved in logistic decisions within tea processing firms participated in the study. This implies all cadres of management who are key in tea processing participated in the study and the majority of them were logistics and field managers (21.9%) who have clear understanding of the automation drivers and their contribution to operational performance among the tea processing firms.

There are four drivers that can be used to justify the firm's investment decisions in logistics automation. From the research findings, the need to improve labour productivity is a modest driver (Mean = 3.400388) in logistics automation in effort to improve organizational performance; the need to improve employees safety is a great driver (Mean = 4.312509) in logistics automation in effort to improve organizational performance; the need to improve product quality is a great driver (Mean = 4.298644) in logistics automation in effort to improve organizational performance; and achievement of reducing the lead time from 23 days to 17 days shows really reduction by 6 days in the overall lead time is a driver in logistics automation.

There are a number of logistics automation applications that can be used to enhance the firm's operational performance. From the research findings, it was found that the overall average mean on the implementation of logistics automation application was 2.526446 meaning the tea processing firms are well equipped with the logistics automation applications which are aimed at improving operational performance.

The automation of the logistics function requires strong drive or motivation with huge investment in the automation applications. The motivation and investment in the logistics automation can be faced by a number

of challenges. It was found that the overall mean of the challenges facing the tea processing forms logistics automation is at 2.80 meaning the logistics automation is not a major challenge hence the need to check on its impact on operational performance.

The motivation to invest in logistics automation is to seek improvements in operational performance. The overall composite average mean on the attributes of operational performance is at 3.917962 meaning the automation of the logistics function has led to 78.35924% (3.92/5*100) improvement in the tea processing firms operational performance. The attributes are not a good measure of operational performance. The secondary data was collected to test the relationship between logistics automation drivers and operational performance. Using weighted scores, each measure of operation al performance was given an equal weight {(9/10)/100}. Then each achievement in every year was multiplied by the weight. Then an average score was computed which was used to compute the composite performance index that could be used to compute the relationship between the drivers and operational performance. The overall score was found to be 47.34% using the quantitative measures of operational performance.

Lastly, in order to establish the influence of logistics automation drivers on operational performance of tea processing firms in Kisii County, there was need to compute the mean for each questionnaire response for each logistics automation drivers against operational performance index. The overall suitability of the model is that 72.2% of the changes in the tea processing firm's operational performance are explained by logistics automation drivers of lead time, need to improve product quality, need to improve labour productivity, need to improve employee safety. From the predictive model, the need to improve labour productivity, product quality and reduce lead time are positive predicators of operational performance in the logistics investment and automation while labour or employee safety is compromised with automation hence the negative coefficient. Based on the collinearity test, the four drivers are distinct and mutually exclusive.

Conclusion

There are four drivers that can be used to justify the firm's investment decisions in logistics automation. Firstly it can be concluded that the greatest drivers in logistics automation are the need to improve product quality, employees' safety, labour productivity and reducing the lead time.

There are a number of logistics automation applications that can be used to enhance the firm's operational performance. Secondly from the research findings, it was concluded that the tea processing firms are well equipped with the logistics automation applications which are aimed at improving operational performance.

The motivation and investment in the logistics automation can be faced by a number of challenges. Thirdly from the research findings it could be concluded that logistics automation is not a major challenge hence the need to check on its impact on operational performance.

The motivation to invest in logistics automation is to seek improvements in operational performance. Lastly it could be concluded that there is a very strong and significant relationship between logistics automation drivers and operational performance among tea processing firms.

Recommendations

The study used four logistics automation drivers within the context of tea processing firms. There is need to explore other logistics automation drivers and how they can influence operational performance. There is to conduct the same study in other sectors like manufacturing and service sector industries and firms.

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