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TEA PRODUCTION AUTOMATION INFLUENCE ON SELECTED MULTINATIONAL TEA COMPANIES FIELD COSTS IN KERICHO AND BOMET COUNTIES, KENYA

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Abstract: **The purpose of this study was to determine Tea Production Automation Influence on Selected Multinational Tea Companies Field Costs in Kericho and Bomet Counties, Kenya. Correlational and descriptive research design was used where census sampling method was used to sample unit managers and field managers from the target population of 91 employee of the three multi-national tea companies in Kericho and Bomet Counties which were; Unilever Tea Kenya Limited, James Finlays Kenya Limited and Williamsons Tea Kenya Limited. The study used open ended structured questionnaire as the primary tool for data collection. Data was analyzed using both the descriptive and inferential statistics. The findings reveal that automation has significantly reduced the cost of land preparation, tea pruning cost; fertilizer application cost and cost of pruning. The study concludes that automation significantly reduced the cost of land preparation; application of fertilizers cost; reduces harvesting costs; it reduces tea production field labour costs and reduction in number of errors thus increasing tonnage of tea weighed and collected. It leads to faster work flow and that a bigger area is covered by few people working using machines.**

Keywords: **Automation, Labour requirements, Production Field Costs.**

1. INTRODUCTION

Tea is a very popular beverage second only to water and is consumed all around the world. Millions of people are engaged in the production and processing of tea, and many more rely on it for their livelihoods. China, India, Kenya and Sri Lanka are the main producers of tea. On estimate, there are 13 million workers involved in tea production worldwide. Tea is an essential item of domestic consumption and is the major beverage in Kenya.

Tea is also considered as the cheapest beverage amongst the beverages available in Kenya International Organizations as per Sustainable Trade Initiative (IDH) Report of 2010. Tea Industry provides gainful direct employment to more than a million workers mainly drawn from the backward and socially weaker section of the society. It is also a substantial foreign exchange earner and provides sizeable amount of revenue to the State and Central Exchequer (IDH Report of 2010). Tea was introduced into Kenya from India by a European settler G.W.L. Caine in 1903 since then Tea planting and production have expanded rapidly from 18,000 tonnes and 24,448 hectares in 1963 to 294,000 tonnes and 131,000 hectares in 2003 (Munyua, 2016).

Tea is harvested all year round, but the highest quality and most expensive is Darjeeling tea which is plucked in April (Deccan Herald 2011). After plucking, the tea leaves are delivered to a factory, preferably within 5 to 7 hours after harvesting to prevent loss of quality (TCC 2010: 4). Tea is a very labor intensive crop companies employ thousands of

workers to maintain and harvest their tea fields. There is typically a daily wage for tea plucking, with a stipulated minimum quantum of leaves to be plucked (TCC 2010). Although Kenya is not the largest producing country, it is the most important exporting country.

Black tea is Kenya's leading agricultural foreign exchange earner and it contributes to 10% of the tea production globally. Kenya commands 21% of the global tea exports outside producing economies with over 3 million people being directly or indirectly employed by the tea industry (Kenya Tea, 2018). According to the Tea Board of Kenya (2014), tea report shows that tea production so far has steadily increased to 3,059 kg per hectare in the estates while the smallholders has increased to 1,956 kg per hectare. The tea estates in Kenya are largely dominated by Unilever Tea Kenya, James Finlay, George Williamsons, Sotik Tea, Eastern Produce Kenya Limited and Sasini Limited (Tea Board of Kenya Report, 2014).

Notwithstanding creating essential foreign currency, this industry utilizes a huge number of workers in estates, preparing processing plants, sales and marketing roads and beverage services enterprises. The largest plantation of tea is owned by the three worldwide tea organizations in both Kericho and Bomet Counties with Unilever Tea Kenya Limited (UTKL) owning a sum of 8,250 hectares under tea while James Finlay's is the second with 5,554 hectares of tea and Williamsons Tea which is a family claimed business (KHRC, 2008).

1.1 Statement of the problem

Globally, agricultural production has continued to face prolonged crisis over the years. This has been attributed mainly to the competition and falling commodity prices worsened by increasing production field costs. Due to low prices in international markets, industry players in Kenya are seeking ways of reducing production field, distribution and manufacturing costs as indicated in Tea Board of Kenya Report of 2014. A study by Slack, Chambers and Johnston (2001) identify two benefits of automation as saving direct costs and reducing variability in the operation. Automation offers various focal points over human work. There is need therefore for this study to establish automation practices adopted by multinational tea companies in Kericho and Bomet so as to advice on the benefits thereof.

Jain Shweta (2011) identified some major factors as being responsible for India's poor performance of tea industry are high input costs, the old age of the bushes, unskilled labor, and lack of infrastructure, poor price realization, legal problems, outdated machinery, high fixed and labor cost, inefficient Tea Board , inability to compete with other tea producing nations in terms of price, quality, packaging, etc.; slow increase in world demand for tea as compared to the subsequent increase in its supply, losing traditional international buyers and more inclination towards domestic market in comparison to the international market.

The study by Chavez, Gimenez, Fynes, Wiengarten and Yu (2013) on Australian businesses suggested that lean internal practices have an impact on the operational performance elements of cost, speed, flexibility, and quality. Campbell, Beer and Pei (2011) note that the cost of product offering is still high despite the technology being more affordable due to material costs being high.

In Kenya, Okinda (2011), depicted that the over reliance on manual tea plucking as a method of harvesting may be more expensive due to the labour costs associated with it and therefore increasing the cost of production of made tea which subsequently squeezes the profit margins. This show that reduction of field production cost will entails use of competent man power thus the need for this study to determine the human resource information system adopted by multinational tea companies in Kericho and Bomet County.

Production field costs for multinational tea companies in Kericho and Bomet counties make up 57-60 % of total production cost. The high field production cost is largely attributable to labour wages.

It is also important to note that margins from the sale of made black tea processed from mechanically harvested is 30-35% US cents over and above that of made black tea from manually harvested green leaf, (Tea Board of Kenya, 2014). There is therefore need for this study on multinational tea companies to determine tea harvesting methodologies they use in the harvesting of their tea so to inform on the field production cost of tea.

The studies do not provide concluding remarks on the contribution of automation in the reduction of high cost of operations in different industries creating a "research gap that the current research sought to bridge by looking at the contribution of automation in reducing the production field costs of tea processing multinational companies in Kericho

and Bomet counties. This study adopted both correlation and descriptive research designs to examine the strategic influence of automation on Tea Production Field Costs in Multi-National Tea Companies in Kericho and Bomet Counties.

1.2 Automation and field costs

Agricultural automation is a term utilized in an exceptionally broad' sense, it not just incorporates the utilization of machines (Ellis, 2007). Regardless of whether portable or stationary, little or extensive, kept running by power and utilized for culturing tasks, collecting and whipping yet additionally incorporates control lifts for water system, trucks for haulage of ranch produce, preparing machines, dairy apparatuses for cream isolating, margarine making, oil squeezing, cotton ginning, rice hulling, and even different electrical home machines like radios, irons, clothes washers, vacuum cleaners and hot plates.

The current competitive environment and increased cost of living has become a detrimental issue for business organizations globally, tea industries notwithstanding. Globally, the tea industry has continually faced declining profitability in the last decade and this has generally been attributed to the exponential increase in the wage bill. The tea industry has therefore tried to relieve this by adoption of mechanical tea plucking technique. However, the take-up of this procedure is shockingly shifted and there has been no clear indication on whether the strategy is viable or not. Therefore, the adoption of machines in tea production requires assets and furthermore gives it a great deal of difficulties, vulnerabilities, and dangers (Rahab and Hartono, 2012).

A fundamental challenge facing tea industry today is the manner by which to make and keep up an upper hand in a turbulent and complex business environment which has become highly volatile, and confronting a flighty and unsteady future. Therefore this means that, for tea industry to thrive, become sustainable and profitable, there is a dire need for them to adopt strategies that are geared towards reducing costs such as labour, production and operational cost as well as responding to the global market shifts. In most tea estates, mechanical tea harvesting has been adopted partially as a strategic tool to decrease the expenses related with tea harvesting. The reason for tea harvesting automation is to reduce costs associated with tea harvesting and to increase the productivity of tea estates. This aids in commercialization of tea harvesting with speed and minimum use of resources with the primary aim of increasing profitability. Automation strategy in the tea industry gives a chance to the tea subsector to improve their proficiency and adequacy with the main aim of gaining competitive advantage.

Unlike in Kenya where introduction of tea harvesting machines was met with resistance from the onset, none of the estates which had adopted mechanical plucking in the Southern Africa region experienced any major hostility from labour towards automation. This is presumably because it was mostly being introduced in areas where people were not much interested in tea plucking - as opposed to Kenya where labour supply exceeds demand. Closer home, some farms in Tanzania have been experimenting with mechanical tea harvesting - small hand held machines and large track driven equipment - since mid-1980s (Jared, 2013).

Even as parties in the Kenyan scene continue to discuss a more humane approach to the situation, pundits say that local tea pickers should nonetheless prepare to take advantage of emerging opportunities in the mechanized tea technology. Though the opportunities might not be as many as they might have been in the decades of manual tea picking, returns will nonetheless be higher for skilled labourers who will operate the more technologically advanced tea plucking systems. According to the firms, leaf quality generally improves with better machines and proper adaptation. Provided quality is assured, machine picked leaves are just as acceptable as those that are manually harvested (Jared, 2013).

Kamwana (2010) did a study on the assessments of the suitability of water system innovation in potato production. The researcher evaluates suitability of water system pump which are mechanized irrigation, tradable pump and drip. The study adopted the use of Net Present Value (NPV) and Benefit Cost Ratio (BCR). It established that NPV under all water system irrigation was sure. The specialist likewise discovered that dribble water system was the most suitable among the three water irrigation system technologies. This is because both NPV and BCR produced a value that was greater than one.

Nyasulu (2009) study looked into the effect of mechanical harvesting technique on quality and yield and saw that mechanical tea culling is quicker than hand picking yet the nature of the finished result and its esteem is exceptionally low. Little has been done on contrasting expenses of these reaping strategies accordingly it stays indistinct and there is no

consistently created data on mechanical collecting strategy. The main problem associated with mechanical harvesting are non-selective harvesting which result lower farm productivity, bush debilitation, and poor recovery of tea bushes after harvest.

Veeraiyan, Thangavelu and Alakiyamanavalan (2014) conducted a study of the effect of modernization of collecting in tea manor to improve the efficiency and quality in India. The researchers analyzed the biochemical parameters of the tea harvested by machines and those manually harvested. They found that the use of integrated tea harvesting system accomplishes ideal creation, quality and benefit in south Indian tea ventures. The researchers found out that mechanical harvesting that can harvest tender shoots of tea could just be accomplished by raising the culling stature at unequivocal interims. Then again, the researchers also determined that over several years of using mechanical harvesting can change the plucking table, therefore allowing only three leaf and buds to emerge what's more, keeping the mother leaf consistently in a plain, flat dimension, therefore this allows for the harvest of tender shoots alone. During harvesting, a flat 'culling table' surface of develop 'upkeep' foliage is safeguarded. This is done as such as to empower new shoots venture over the surface along these lines making them simpler to expel. The collected shoots are then prepared in to made green or dark tea.

Vishwanatha (2005) completed a relative investigation of mechanical sections the manual sifting strategies in maize. He utilized both limited and non-limited techniques to evaluate practicality of two machines. The machines used for the study were maize thresher and sheath evacuation maize thresher. The analyst utilized IRR, NPV and BCR these are limited strategies and recompense period as a non-limited strategy. The scientist discovered that sheath evacuation maize thresher was more reasonable than maize thresher. Sheath expulsion maize thresher had a higher NPV, higher BCR and higher IRR than maize thresher. Compensation period was the equivalent for the two machines; time taken to recuperate the underlying speculation was nearly the equivalent.

1.3 Factor Analysis

Prior to the extraction of the factors, several tests should be used to assess the suitability of the respondent data for factor analysis. These tests include Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The KMO index ranges from 0 to 1, with 0.50 considered suitable for factor analysis. The Bartlett's Test of Sphericity should be significant ($p<.05$) for factor analysis to be carried out (William, *et al*., 2010).

Table 1: KMO and Bartlett's Test Results for Automation

KMO and Bartlett's Test Results for Automation		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.842
Bartlett's Test of Sphericity	Approx. Chi-Square	885.419
	Df	15
	Sig.	.000
KMO and Bartlett's Test on Field Cost		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.710
Bartlett's Test of Sphericity	Approx. Chi-Square	214.169
	Df	10
	Sig.	.000

Source: Research data (2019)

Table 1 shows the result of KMO and Spherical Bartlett tests, whose value ranges from 0 to 1 and is an indicator for comparing correlation coefficient of observation and partial correlation coefficient. The value of Kaiser-Meyer-Olkin for automation was 0.710 and for tea production field cost was is 0.710. This shows that the explanatory effect of factor analysis is stronger thus suitable to use factor analysis (William et al., 2010). The results of Bartlett's Test of Sphericity had a significance of 0.00 thus should fail to reject the null hypothesis which means the variables have a strong association.

1.4 Automation and Field Costs

Respondents gave their response on statement which related to the effect of automation and field costs in Multi-National Tea Companies in Kericho and Bomet Counties, Kenya. Their response were on a likert scale where strongly agree (SA)

was denoted by digit 5, agree (A), was denoted by digit 4, Undecided (U), was denoted by digit 3, Disagree (D), was denoted by digit 2 and Strongly Disagree (S D) was denoted by digit 1. The results of their opinion on the statement were as per Table 2.

Table 2: Automation and field cost

Statement on Automation	SA	A	U	D	SD	Mean	Std. Dev
1. Automation has significantly reduced the cost of land preparation by reducing man days employed per hectare	41 (49.4%)	19 (22.9%)	0 (0.0%)	9 (10.8%)	14 (16.9%)	3.70	1.57
2. Automation fertilizer application has significantly reduced the cost of application by reducing man days employed per hectare	31 (37.3%)	25 (30.1%)	4 (4.8%)	10 (12.0%)	13 (15.7%)	3.56	1.50
3. Automation has significantly reduced the cost of pruning by reducing man days employed per hectare	47 (56.6%)	13 (15.7%)	0 (0.0%)	14 (16.9%)	9 (10.8%)	3.84	1.52
4. Automation harvesting has significantly reduced labour costs by reducing man days employed per hectare	25 (30.1%)	35 (42.2%)	0 (0.0%)	11 (13.3%)	12 (14.5%)	3.55	1.43
5. Automation has significantly reduced tea production field labour costs	43 (51.8%)	17 (20.5%)	0 (0.0%)	15 (18.1%)	8 (9.6%)	3.80	1.47
6. Automation has influenced overall Tea Production Field Costs	45 (54.2%)	15 (18.1%)	0 (0.0%)	7 (8.4%)	16 (19.3%)	3.73	1.64

Source: Research data (2019)

Table 2 shows that automation has significantly reduced the cost of land preparation by reducing man days employed per hectare since majority of the respondents who were 60 representing 72.3% agreed to it while 23 representing 27.7% of the respondents disagreed.

Automation has moderately affected cost of preparing land (mean of 3.71) whose variation nears significance (standard deviation of 1.58). It is true to say that automated fertilizer application has significantly reduced the cost of application by reducing man days employed per hectare since 56 representing 67.4% of the respondents agreed to it while 23 representing 17.7% disagreed that automation reduce the cost of application of fertilizers by reducing mandays per hectare. The respondents who were undecided were 4 representing 4.8% of all the respondents. Automation has affected the cost of application of fertilization moderately (mean of 3.56) with a standard deviation of 1.51.

Automation has significantly reduced the cost of pruning by reducing mandays employed per hectare as is attested by majority of the respondents who were 60 representing 72.3% while 23 representing 27.7% of the respondents disagreed to reduction of pruning cost by use of automation. This is confirmed that automation somewhat reduced cost of pruning for it had a mean of 3.85 with a standard deviation of 1.52.

Majority of the respondents who were 60 (72.3%) agreed that automation harvesting has significantly reduced labour costs by reducing man days employed per hectare, this was disagreed by 23 representing 27.8% of the respondents. Automated tea pruning application has somewhat affected cost by reducing mandays (mean of 3.85), the reduction near noticeable (standard deviation of 1.52).

Automation has significantly reduced tea production field labour costs since majority of the respondents who were 60 representing 72.3% agreed to it while 23 representing 27.7% of the respondents disagreed. It is true that automation has influenced overall tea production field costs since majority of the respondents who were 60 representing 72.3% agreed while 23 representing 27.7% of the respondents disagreed. Automation somehow effect reduction of tea production field cost for it had a mean of 3.73 whose variation nears significance with a standard deviation of 1.64.

The findings reveal that automation has significantly reduced the cost of land preparation by reducing mandays employed per hectare; it has significantly reduced the cost of application of fertilizers by reducing man days employed per hectare; has significantly reduced the cost of pruning by reducing man days employed per hectare; has significantly reduced harvesting labour costs by reducing man days employed per hectare; has also significantly reduced tea production field labour costs thus influencing overall tea production field costs.

The research findings are inconsistent with Nyasulu (2009) who studied the effect of mechanical harvesting techniques on quality and yield and saw that mechanical tea culling is quicker than hand picking yet the nature of the finished result and its esteem is exceptionally low. The findings also concur with Veeraiyan, Thangavelu and Alakiyamanavalan (2014) who found out that the use of integrated tea harvesting system accomplishes ideal creation, quality and benefit in south Indian tea ventures.

The study findings also agrees with Wijeratne (2012) who asserts that mechanical harvesting offers speedy and upgraded work profitability and lessens the expense of work amid reaping and therefore there is a need for tea industry to adopt the use of technology in tea harvesting operations.

Table 3: Importance of automation on reduction of field cost

Statement	1	2	3	4	5
1. Automation is important	15 (18.1%)	10 (12.0%)	3 (3.6%)	35 (42.2%)	20 (24.1%)
2. Automation improves productivity	10 (12.0%)	8 (9.3%)	2 (2.4%)	33 (39.3%)	30 (36.0%)

Source: Research data (2019)

Table 3 shows that majority of the respondents who were 35 respondents representing 42.2% noted that automation is moderately important, 20 respondents representing 24.1% noted that automation is important while 15 respondents representing 18.1% of the respondents said that automation is not important and 10 respondents representing 12.2% of the respondents said that automation is of little important. The respondents who were undecided were 3 representing 3.6% of the respondents.

Majority of the respondents who were 33 representing 39.3% of the respondents said that automation moderately improves productivity, 30 representing 36.0% of the respondents noted that automation improves productivity while respondents who were 10 representing 12.0% said that automation does not improves productivity, 8 representing 9.3% of the respondents noted that automation improves productivity to a very little extent. The respondents who were undecided were 2 representing 2.4% of the respondents.

1.5 Field costs

Respondents gave their response on statement which related to the effect of field costs in Multi-National Tea Companies in Kericho and Bomet Counties, Kenya.

Table 4: Field cost

Statement on Field Cost	SA	A	N	D	SD	Mean	St. Dev
1. Tea harvesting automation affects the labour costs	40 (48.2%)	20 (24.1%)	0 (0.0%)	14 (16.9%)	9 (10.8%)	3.87	1.42
2. Tea harvesting automation affects the operation costs	43 (51.8%)	17 (20.5%)	0 (0.0%)	14 (16.9%)	9 (10.9%)	3.92	1.44
3. Tea harvesting automation affects utility costs	47 (56.6%)	16 (19.3%)	0 (0.0%)	16 (19.3%)	4 (4.8%)	4.05	1.32
4. Tea harvesting automation affects the human resource costs	41 (49.4%)	15 (18.1%)	0 (0.0%)	20 (24.1%)	7 (8.4%)	3.82	1.45
5. Labour, insurance, utility and management costs determine tea harvesting costs	36 (43.4%)	16 (19.3%)	0 (0.0%)	23 (27.7%)	8 (9.6%)	3.61	1.50

Source: Research data (2019)

Table 4 shows that tea harvesting automation affects the labour costs since majority of the respondents who were 60 representing 72.3% agreed while 23 respondents which represented 27.7% of the respondents disagreed. Tea harvesting automation somehow affects labour costs as shown by a mean of 3.8718 and a standard deviation of 1.43. Majority of the respondents who were 60 representing 72.3% of all the respondents agreed that tea harvesting automation affects the operation costs. The respondents who disagreed that tea harvesting automation affect the operation cost were 23 respondents representing 27.7% of all the respondents. Tea harvesting automation somehow affect operation costs for it had a mean of 3.9231 and a standard deviation of 1.45. Tea harvesting automation affects utility costs as attested by the majority of the respondents who were 63 representing 75.9% of all the respondents agreed to it.

The respondents who disagreed that tea harvesting automation affects utility costs were 20 representing 24.1% of all the respondents. Automation of tea harvesting automation largely affects utility costs since it had a mean of 4.0513 and a standard deviation of 1.33.

Majority of the respondents who were 56 representing 67.5% of all the respondents agreed that tea harvesting automation affects the human resource costs. The respondents who disagreed to tea harvesting automation to affecting the human resource costs were 27 representing 32.5% of all the respondents. Tea harvesting automation moderately affects human resource costs since it had a mean of 3.8205 and a standard deviation of 1.46. Labour, insurance, utility and management costs determine tea harvesting costs. This is true since majority of the respondents who were 52 representing 62.7% of all the respondents agreed to it while 31 respondents representing 37.3% of all the respondents disagreed. This implies that automation affects; labour costs, operation costs; utility costs and human resource costs. Labour, insurance, utility and management costs determine tea harvesting costs. Labour, insurance, utility and management costs somehow determine tea harvesting costs as shown by a mean of mean of 3.6154 and a standard deviation of 1.51.

Table 5: ANOVA on automation using SPSS version 22

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3.698	8	.462	3.323	.003[b]
	Residual	9.597	69	.139		
	Total	13.295	77			

a. Dependent Variable: Tea Production Field Cost
b. Predictors: Automation

Source: Research data (2019)

Table 5 shows that the significance value is 0.003 (i.e., p = .003), which is below 0.05 therefore, automation is significant.

1.6 Effect of Automation on Field Costs

Automation has significantly reduced the cost of land preparation by reducing man days employed per hectare since majority of the respondents who were 60 agreed to it. Mechanical fertilizer application has significantly reduced the cost of application by reducing man days employed per hectare since 56 respondents agreed to it. Automation has significantly reduced the cost of pruning by reducing man days employed per hectare is true as agreed by majority of the respondents who were 60 respondents. Majority of the respondents who were 60 agreed that mechanical harvesting has significantly reduced labour costs by reducing man days employed per hectare. Automation has significantly reduced tea production field labour costs since majority of the respondents who were 60 agreed to it. It is true that automation has influenced overall Tea Production Field Costs since majority of the respondents who were 60 agreed while 23 respondents disagreed.

1.7 Automation on Field Costs

Tea harvesting automation affects the labour costs since majority of the respondents who were 60 agreed. Majority of the respondents who were 60 agreed that tea harvesting automation affects the operation costs. Tea harvesting automation affects utility costs as attested by the majority of the respondents who were 63 agreed to it.

Majority of the respondents who were 56 agreed that tea harvesting automation affects the human resource costs. Labour, insurance, utility and management costs determine tea harvesting costs. This is true since majority of the respondents who were 52 agreed to it. Tea harvesting automation affects labour and wage costs since majority of the respondents who were 60 agreed. Tea harvesting automation affects management costs according to 55. Majority of the respondents who were 67 agreed that they will recommend multination tea companies to adopt Human Capital Information System in their organization.

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2. CONCLUSION

The study concludes that automation significantly reduced the cost of land preparation by reducing man days employed per hectare; it reduces the cost of application of fertilizers by reducing man days employed per hectare; it reduces the cost of pruning by reducing man days employed per hectare; it reduces harvesting labour costs by reducing man days employed per hectare; it reduces tea production field labour costs and thus it influences the overall tea production field costs.

3. RECOMMENDATIONS

There is need for multinational tea companies to fully embrace tea harvesting technology since it reduces the cost of production by reducing the number of employees engaged per hectares and also it reduces the number of management team. It also leads to faster work output and improve production and productivity. It leads to faster work flow and that a bigger area is covered by few people working using machines.

Suggestions for further studies

Further study can be undertaken on the same study in other sectors like manufacturing and service sector industries and firms. Also a study can be done on the organizational impact of automation.

REFERENCES

[1] Campbell, R. I., De Beer, D. J., & Pei, E. (2011). Additive manufacturing in South Africa: building on the foundations. *Rapid Prototyping Journal*, 17(2), 156-162.

[2] Chavez, R., Gimenez, C., Fynes, B., Wiengarten, F., & Yu, W. (2013). Internal lean practices and operational performance: The contingency perspective of industry clockspeed. *International Journal of Operations & Production Management*, 33(5), 562-588.

[3] Dan B. (2015). Mechanized Tea Harvesting for Lower Cost. *World Tea Academy* 19 (3), 1-14.

[4] Deccan Herald. February 2011. "Storm brewing in tea cups of Darjeeling." http://www.deccanherald.com/ content/141651/storm-brewing-tea-cups-darjeeling.html. Accessed 8-3-2019.

[5] Ellis, R.T. (2007). Machine plucking, Tea Research foundation. *Quarterly newsletter*.

[6] IDH. 2010. *Case study Unilever sustainable tea Part 1: Leapfrogging to mainstream.* http://www. idhsustainabletrade.com/thee-learning

[7] International Tea Committee (2018), *ITC Report 2018*,

[8] Jain Shweta (2011), "*Indian Tea Industry -An Analysis Using Concept of Forward Engineering"* International Journal of Food Sciences and Nutrition, June 2011, 14(2); Pp-17-38.

[9] Kamwana, B. (2010). *Assessing the financial viability of investing in small irrigation technology for potato production in Dedza and Ntchea*, Nairobi: Master of Science thesis university of Nairobi.

[10] Kenya Tea. (2018, January 21). *Kenya Tea*. Retrieved from About the black and green tea grown in Kenya: http://www.kenya-information-guide.com/kenya-tea.html

[11] Kevin Gingerich, Bosch Rexroth (2015); Lean production and automation; Select the best production platform for Lean operations.

[12] KTDA (2011). *Kenya Tea Development Agency Ltd*, Statistics.

[13] KTDA. (2011, May 12). *Chai Bulletin*. Retrieved from Kenya Tea Development Aency Holdings Ltd: http://www.ktdateas.com

[14] Kunyaga, A. (2017, April 14). Mechanised Tea Harvesting the Best Bet. *Daily Nation*, p. 1.

[15] Maina, J., & Kaluli, W. (2013, December). Assessment of mechanical harvesting of tea and its viability for use in Kenya. *In Scientific Conference Proceedings*.

[16] Maina, J., & Kaluli, W. (2013). Assessment of Mechanical Harvesting of tea and its Viability for Use in Kenya. *JKUAT Report*, 207- 213.

[17] Munyua C. Mwangi (2016). The Causes of High Cost of Tea Production and Sustainability of the Tea Subsector in Kenya. *International Journal of Science and Research* (*IJSR*), 5 (9), 1186 - 1189

[18] Nyasulu, S. K. (2006). Mechanical harvesting of tea in Malawi: a research review. *Hand*, 14(3), 2Cm.

[19] Okinda, P. (2011). *Tea in Kenya: Production and country profile*. Nairobi: Maseno University, Kenya unpublished.

[20] Ongongâ, J. O. (2013). Innovation in the tea industry: the case of kericho tea, Kenya. *Global Journal of Management and Business Research*.

[21] Rahab & Hartono J. (2012). Adoption of Information Technology on Small Businesses: The Role of Environment, Organizational and Leader Determinant, *International Journal of Business, Humanities and Technology*, 2(4), 60-66

[22] Ravichandran, R. & Partiban, R. (1998). The impact of automation of tea harvesting on quality of South India CTC teas. *Food Chemistry*, 63: pp. 61-64.

[23] Salter, W. (2007). *Productivity and technical change*. *4th Ed.* Cambridge: Cambridge University Press.

[24] Slack, N., Chambers, S., & Johnston, R. (2001). *Operations Management (3th Edition).* Essex: Prentice Hall.

[25] TCC. 2010. *Tea Barometer 2010*. http://www.teacoffeecocoa.org/tcc/Publications/Our-publications

[26] Tea Research Foundation. (2000). Mechanical harvesting of tea. *A research review.*

[27] TeaMan. (2018, August 07). *Manual Harvesting of Tea*. Retrieved from Tea Plantation Agronomy: http://tea-plucking.blogspot.com

[28] Unilever Tea (2019). www.unilever.co.ke/ourcompany/aboutunilever/

[29] Veeraiyan N, Thangavelu, B & Alakiyamanavalan L. (2014). Impact of modernization of harvesting in tea plantation to improve the productivity and quality. *Journal of Environmental Science, Toxicology and Food Technology* 8 (9). 55-59

[30] Vishwanatha, B. (2005). *A comparative study of mechanical v/s traditional threshing methods.* Nairobi: M.Sc. Agriculture thesis university of Agricultural Science unpublished.

[31] Wijeratne, M. (2003). Harvesting policies of tea (Camellia sinensis L.) for higher productivity and quality. *Tropical Agricultural Research and Extension*, 6(14), 91-97.

[32] Wijeratne. M. (2012). Pros and Cons of Mechanical Harvesting: A Review of Experience on Tea Harvesting Tested by Tea Research of Sri Lanka. Tea Research Institute of Sri Lanka. *Tropical Agricultural Research and Extension* 21 (2),1-9

[33] Williamson Tea (2019). www.williamsontea.com/about-us/