

EFFECTS OF TECHNOLOGY ON TEA FACTORIES PROJECT PERFORMANCE: A CASE OF TRANS NZOIA COUNTY, KENYA

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Abstract: The impact of Tea factories on the livelihood of over 560,000 tea farmers in Kenya who deliver green leaf to tea factories is of great economic value. The purpose of this study was to analyze the impact of technology on tea factories project performance in Trans Nzoia County. This study was based on the following specific objective: To determine the effect of cost reduction on tea factories project performance in Trans-Nzoia County. The study was guided by Stakeholder Theory and Constraint Theory. The study used mixed methodology and descriptive research design. A pilot test was done in Chebut Tea Factory in Nandi County which falls outside the researchers' scope of research area. The target population was 90 employees of Kapsara and Elgon tea and the same number as the sample given this is a census study. Data was collected using structured questionnaires, interviews and document analysis. Once ascertained, data duly collected was analyzed using descriptive statistics and Statistical Package for Social Sciences (SPSS). Cost reduction had positive relationship on tea factories project performance. The r value is 0.802 which is relatively strong at 2 tailed significance of 0.000 which is below 0.01 level of significance. The results emanating from this research are of benefit to all project managers in tea factories and also line managers who will enhance the application of this findings to boost the performance of factory operations and furthermore boost returns to shareholders.

Keywords: tea farmers, tea factories, shareholders.

1. INTRODUCTION

The impact of Tea factories on the livelihood of over 560,000 tea farmers in Kenya who deliver green leaf to tea factories is of great economic value. Across the value supply chain, more than 10,000 people are directly employed in the small holder sector, indirectly benefitting over four million people. Factories engages hundreds of transporters and scores of small and large scale business partners who supply plant and machinery, vehicle spare parts, fuel and other operational and maintenance services. It is also notable that among the many of Kenya's export crops, tea is one of those crops that have maintained an upward trend in production and export earnings (Namu et al., 2014).

However the tea industry has had to contend with high costs of production and mismanagement that threatens its survival. There is need for immediate interventions to manage the vices. The tea industry in Kenya has to contend with the rising cost of production and in particular the high cost of labor as one of their key challenges. Blowfield and Dolan(2010) shows that an analysis carried out by the Unilever management indicated that labor costs constituted about 43 per cent of total costs in 2014. This figure had rose to about 55% of total costs by 2016. Another report by Sanne (2008) on Sustainability issues in the Tea Sector revealed the factors contributing to the high cost of production are the high costs of farm inputs particularly fertilizers, the high costs of energy/fuel at the factories, numerous taxes and levies, mismanagement, high overhead costs, bad agricultural practices and low labor productivity. Also Kimathi and Muriuki (2013), observes that the tea industry is subject to more than 30 taxes, fees, levies, charges and payments that increase the

cost of doing business and adds the administrative burden on organizations seeking to comply. Face with such challenges, Bello et al (2016) argued that there is need for major and minor changes in a business firm's strategic direction.

Use of modern technology is also a strategy of reducing costs of production. One of the most revolutionary changes made was the introduction of Continuous Fermentation Units (CFUs) at the factories. These are computerized "intelligent machines" that literary transformed the way tea was manufactured by eliminating human intervention in the process of fermentation. The result was greater consistency in the quality of made tea, more efficient production and a lowering of labor costs since a single CFU replaced almost 40 workers (Kimathi & Muriuki, 2013).

The other area of target in cost reduction was procurement. Electronic/online procurement is a system that can be used to cut down procurement related expenses. As observed by Rayport and Bernard (2005), switching costs for consumers who shop on the internet are significantly lower

Battistoni et al (2013) in a study in Roma and Italy on Analysis of the Effect of Operations Management Practices on Performance noted that enterprises all over the world operate in highly dynamic environments where key resources are scarce and uncertainty in business and is common. This shows the need for focusing on technology as one of the endeavors to manage such dynamism in operations and satisfy the stakeholders. The frequent and seemingly continuous changes in management of projects over time have resulted in the elevation of technology as an important basis of communication in organizations (Rimmington, Dickens, & Pasquire, 2015). It follows from this that indeed ICT is critical in implementation and project performance in general.

In a study in USA on Impact of Information Technology on Mass Customization Capability of Manufacturing Plants, it was noted that Mass Customization production system combines the advantages of both mass production and product customization, benefiting from the cost-saving efficiency of the former and the flexibility associated with the latter (Peng, Liu, & Heim, 2011).

A study in Vietnam proposed a model of innovation process and technology in food factories in order to influence capacity, leadership and performance of organizations. Changes in technological and highly competitive market conditions strongly influence the innovation needs of enterprises. Enterprises have to seek for new product and process development to meet new customer requirements through technology transfer or inside research and development (Ngiyen & V, 2013).

Considering a global view, a study on Additive Manufacturing Technology found out that the major factors affecting production in the United States of America are the development of standards, improvements in the selection and affordability of inputs and also increasing the reliability and accuracy of processes and equipment in use. The increase in breadth and sophistication of emerging technological applications drive needs for improving process control, materials and inspection for safety purposes (Johnson, 2014). A study on firm performance stated that informal and formal communication within departments; internal integrating and networks always boost performance.

In a research on process operations, business executives saw technology as impactful on their functions (The Impact of Technology on Business Process Operations, 2014). In a 2008 Sloan Industry Conference, it was noted that new technologies expand markets via additional distribution channels, creative revenue streams, increasing employment and generally altering occupational mix (Figuroa, Gray, & Cerio, 2008). Any new technology will always have an impact on the operational system of an organization and even performance as it affects costs, revenue and even employment.

According to a study in Islamabad, Pakistani, training that is accompanied with continuous focus on development in aspects of technology affects the performance of organizations (Khan, Khan, & Khan, 2011).

A study conducted in Rivers State of Nigeria noted that the increasing customers` demand for high quality products and more flexibility all at lower costs have generated a new trend in the industries. This can be mitigated by effective adoption of various production processes(Uzochukwu & Ossai, 2016). Technology is one of the aspects to be embraced in the production processes to ensure flexibility in operations and quality output regionally in East Africa and also the continent as a whole.

A study on Information technology revealed that a factory has to attend to the varied demands of its consumers in regard to using efficient tools to produce quality goods (Rana, 2013). Indeed, world renowned organizations like Boeing, Allen-Bradley and Black and Decker have used automation of factories as a basis to improve manufacturing operations.

At international, national and local levels, project performance is key for the success of organizations. The researcher sees use of technology to be a solution to the rising costs that render enterprises non-competitive in Kenya. Factories in Kenya have been facing the challenge of increase in cost of operations (Kagira, Kimani and Kagwithi, 2012). This led to factories adopt various technology as a way of dealing with this challenge (KTDA, 2014). In particular, most factories had to: change the manual tea processing system to automated system, the Continuous Fermentation Unit; change steam boilers from furnace fuel steam boilers to fire steam wood boilers; and, computerize the tea buying processes (KTDA, 2014).

Lean production and supply chain management approach is gaining high attention in the current business world as one way of staying ahead of the competitors and achieving success for the enterprise stakeholders and many firms including sugar manufacturing companies in Western Kenya have been quick in embracing the same. Thus for proper operational performance, the approaches cannot be taken for granted (Mukopi & Iravo, 2015).

2. COST REDUCTION EFFECTS ON TEA FACTORIES PROJECT PERFORMANCE

Cost reduction is an output element in regard to project performance. Rana(2013) concludes that reduced scrap or waste and shorter lead times are examples how costs are reduced when technology is used effectively in the factories. According to (Thomas & Gilbert, 2014), among the many costs in a manufacturing sector, obsolescence costs, initial costs of production, stocking costs and transport costs are included. Such costs affect project performance. Apart from alignment of strategy and continuous improvement in processes, corporate firms also focus on reduction of costs (Kushwaha, 2012). Issues of cost are critical in the modern business operations as they can positively or negatively impact on project performance.

According to Uzochukwuet. al(2016) the increasing customers` demand for high quality products and more flexibility all at lower costs have generated a new trend in the industries. This can be mitigated by effective adoption of various production processes. This shows that cost reduction processes are so key and they can majorly be enhanced by the employment of technology in the factory production operations.

Computerization of tea collection process at the buying centers was implemented to enhance accountability and accuracy of records as a way of reducing operational costs, and enhancing information sharing among all stakeholders (Kagira, Kimani and Kagwithi, 2012).According to Ngiyen(2013), a firm has to face with the most challenge of the best use of available resources to ensure that the full range of assets including employees, technology, capital, information, intangible asset and market position can be accessed to carry out innovation activities and technology transfer.

To save tea farmers from the rising costs of operations, factories took a bold step in adopting innovations in its business. The adopted innovations were process innovation and organizational innovation (KTDA, 2014). Process innovation entails the implementation of a new or significantly improved delivery or production method. It includes significant changes in equipment, techniques and/or software (OECD Oslo, 2005). The processes innovations undertaken by factories were automated tea processing by adopting Continuous Fermentation Unit and converting the steam boilers from furnace fuels to firewood fuel with the aim of reducing the operational costs (KTDA, 2014), the newly deployed tea leaf collection trucks have a higher rate of motor vehicle turn around resulting in collection of bigger volumes of green tea leaves due to their efficiency and minimal breakdowns. Modern machinery which can handle big volumes of input can be cost effective. An example in the tea processing activity is an electronic weigh feeder which can weigh up to 6000Kgs of green leaf per hour. Another in the tea processing factories is installation of Cutting, Tearing and Curling (CTC) machines 42" Vikram Jumbo which can handle a capacity of 3000Kg. per hour. The efficiency of this machinery has led into improved rate of the quantity of the tea processed per cycle while reducing the time taken to process that tea.

The automated tea processing systems are intelligent machines that transformed the way tea was manufactured by eliminating human intervention in the process of fermentation (KTDA, 2014). This was done with a view to reducing the labor cost as less people were required to operate the plant as compared to the old system. The system was also put in place to improve quality as the system does not depend on human intervention for the various stages of processing of tea (KTDA, 2014). Due to the rising costs of furnace fuels, factories opted to change from furnace fuel steam boilers to firewood steam boilers (Kagira, Kimani and Kagwithi, 2012).

In mechanical processes, an operator loads a piece of equipment which can work without further intervention. Mechanized systems have the disadvantages of high capital cost and inflexibility. They still need operators to do some of the aspects of the work operations and deal with problems. Unfortunately, humans slow down a process, add variability to the quality and increase unit costs and this is the major reason why automated processes have been adopted. Automation overcomes the problems of a mechanized process because automated equipment performs series of operations without any operator involvement. Factories have adopted automation by introduction of continuous chemical withering (CCW), continuous physical withering (CPW) machines and continuous fermenting units (CFU) which has drastically improved speed, machine availability and flexibility. These are computerized “intelligent machines” that literary transformed the way tea was manufactured by eliminating human intervention in the process of fermentation. The result was greater consistency in the quality of made tea, more efficient production and a lowering of labor costs since a single CFU replaced almost 40 workers (Kimathi & Muriuki, 2012).

Rana(2013) concluded that features such as bar codes assist in improving quality control. Electronic controls and digital displays increase speed and precision during the manufacturing process. IT extensively reduces the cost of product design, supply chain management and the manufacturing processes.

3. METHODOLOGY

This chapter describes the research design, population, sampling frame, sample and sample technique, research instruments, data collection procedure, pilot that was undertaken as well as the researcher’s data processing and analysis of the same data collected. Research design is a plan or a framework for guiding a study (Kothari, 2008). The design connects the questions or objectives of the study to the data gathered. Descriptive survey research design was used in this study. The target population for the study was 90 respondents. Therefore, the study sample size was 90 respondents as in the sample frame. This means that the study adopted a census sampling technique to select all the 90 respondents to represent our sample size. The researcher used both primary and secondary data collection instruments to collect both primary data and secondary data respectively. Data was collected by use of a semi structured predesigned questionnaire Primary data of both quantitative and qualitative type was collected by the researcher through observations, checklist, interview schedules and questionnaires. A pilot test of 20 questionnaires to 20 respondents was done in Chebut Tea Factory in Nandi County to test the validity and reliability of data collection instrument The changes after pilot outcomes were incorporated into the instruments which were adjusted accordingly. Cronbach alpha test of 0.7 and above was used. Analysis of the data was done using *spss* 21 software. Comparative tables and percentages were also used for data analysis and presentation. Inferential statistics were also used-Pierson correlation. Multiple regressions model/analysis was further generated to determine the relationship between independent and dependent variable. The model enables the researcher to predict value of the outcome binary variable given values of the explanatory variables.

4. RESULTS ANALYSIS AND DISCUSSION

The targeted population of the study was 90 respondents but only 72 who filled in the questionnaire. This means the response rate was 80.0 percent. According to Best & Khan (2007) a response rate of 50.0 percent is considered adequate, 60.0 percent good and above 70.0percent very good.

Results of the Pilot Study: A pilot test of 20 questionnaires to 20 respondents was conducted in Chebut Tea Factory in Nandi County. The questionnaire tool returned a highly acceptable score since all coefficients are above 0.75. An internal consistency technique using Cronbach's alpha was then applied to measure the reliability of all the questionnaires issued to different groups of pilot respondents. The respondent age in years was the first item on the questionnaire. Table 4.2 summarizes this information indicating a majority 36.0 percent of respondents were aged between 40-49 years old. On the highest level of education attained, 43.0 percent have university level,29.0 percent have college level, 10.0 percent are post graduate level of qualification, 8.0 percent of the respondents said that they have Secondary school certificates, while 10.0 percent have Professional qualifications. Results showed that 39.0 percent had between 5 – 10 years’ experience 33.0 percent had between 10 – 15 years of experience in the service. 13.0 percent of the respondents had less than 5 years’ experience in tea factories project while 10.0 percent had served for 15 – 20 years, and 5.0 percent had served in tea factories project for over 20 years.

Cost reduction is an output element in regard to project performance. Rana (2013) concludes that reduced scrap or waste and shorter lead times are examples how costs are reduced when technology is used effectively in the factories. According to (Thomas & Gilbert, 2014), among the many costs in a manufacturing sector, obsolescence costs, initial costs of production, stocking costs and transport costs are included. Such costs affect project performance. Apart from alignment of strategy and continuous improvement in processes, corporate firms also focus on reduction of costs (Kushwaha, 2012). Any new technology will always have an impact on the operational system of an organization and even performance as it affects costs, revenue and even employment.

The objective of the study was to determine the effect of cost reduction on tea factories project performance in Trans-Nzoia County.

It was noted that new technologies expand markets via additional distribution channels, creative revenue streams, increasing employment and generally altering occupational mix (Figuroa, Gray, & Cerio, 2008). The findings showed that majority 33.0 percent of the respondents disagreed while 24.0 percent strongly disagreed that there is a reduction of scrap or waste and shorter lead times when technology is used effectively in the factories leading to high profits. This cumulatively gave a majority of 57.0 percent. But 20.0 percent strongly agreed, 19.0 percent agreed while 4.0 percent were neutral. This results revealed clearly that majority disagreed that there is a reduction of scrap or waste and shorter lead times when technology is used effectively in the factories leading to high profits. This might be due to a contribution of other factors that lead to high profits that were overlooked in the study.

The results of the study further on whether issues of cost are critical in the modern business operations as they can positively or negatively impact on project performance. They showed that while majority 40.0percent agreed; fewer 21.0 percent strongly agreed, 24.0 percent disagreed and 15.0 percent were neutral. This cumulatively showed that 61.4percent agreed meaning the issues of cost are critical in the modern business operations as they can positively or negatively impact on project performance. The findings of this study intermarries with those of a study by Thomas and Gilbert(2014) where they found out that among the many costs in a manufacturing sector, obsolescence costs, initial costs of production, stocking costs and transport costs are included. Such costs affect project performance.

Result from table above on whether computerization of tea collection process at the buying centres was implemented to enhance accountability and accuracy of records as a way of reducing operational costs, and enhancing information sharing among all stakeholders. The results showed that majority percent 30.0 agreed while 31.0 percent strongly agreed, 11.0 percent strongly disagreed, 27.0 percent disagreed while 1.0 percent was neutral that computerization of tea collection process at the buying centres was implemented to enhance accountability and accuracy of records as a way of reducing operational costs, and enhancing information sharing among all stakeholders. This implies that majority 61.0 percent agreed that computerization of tea collection process at the buying centres was implemented to enhance accountability and accuracy of records as a way of reducing operational costs, and enhancing information sharing among all stakeholders. According to Uzochukwu et al (2016) the increasing customers` demand for high quality products and more flexibility all at lower costs have generated a new trend in the industries. This can be mitigated by effective adoption of various production processes. This shows that cost reduction processes are so key and they can majorly be enhanced by the employment of technology in the factory production operations.

Finally, the results of the study also showed that 28.0 percent strongly agreed, 26.0 percent agreed, 7.0 percent were neutral, 23.0 percent disagreed and 16.0 percent strongly disagreed that there is decline/reduction on switching cost and transaction costs involved in announcing orders requests and to receive bids. This implies that 54.0 percent agreed that there is decline/reduction on switching cost and transaction costs involved in announcing orders requests and to receive bids. According to Thompson *et al*, (2005), the instant communication features of the internet combined with all the real time data sharing and information availability have further effect of breaking down corporate bureaucracies and reducing overhead costs. This means management process like order processing, invoicing, customer accounting, and other kind of transaction costs can be handled fast, accurately, and with less paper work and fewer personnel. The time savings and transaction cost reductions associated with doing business online can be quite significant across both company and industry as it uses internet for purposes of efficiency and effectiveness.

The results are presented in the Table 4.1: below:

Table 4.1: Effect of Cost Reduction on Tea Factories Project Performance in Trans-Nzoia County

Variable	SA	A	N	D	SD	Total
There is a reduction of scrap or waste and shorter lead times when technology is used effectively in the factories leading to high profits	20.0	19.0	4.0	33.0	24.0	100
Issues of cost are critical in the modern business operations as they can positively or negatively impact on project performance	40.0	21.0	15.0	24.0	0.0	100
Computerization of tea collection process at the buying centres was implemented to enhance accountability and accuracy of records as a way of reducing operational costs, and enhancing information sharing among all stakeholders	31.0	30	1.0	11.0	27.0	100
A decline/reduced on switching cost and transaction costs involved in announcing orders requests and to receive bids	28.0	25.0	8.0	26.0	13.0	100

Results of Inferential Statistics:

Effect of cost reduction on tea factories project performance

Pearson Correlation

The study analysed data on the effect of cost reduction on tea factories project performance and obtained the Pearson correlation and presented the results in Table 4:2 below.

Table 4.2: Pearson Correlation of effect of cost reduction on tea factories project performance

Variable	Test	tea factories project performance
effect of cost reduction	Pearson Correlation	.802**
	Sig. (2-tailed)	.000
	N	75

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4:2-the interpretation of correlation coefficient shows that cost reduction has positive relationship on on tea factories project performance. The r value is 0.802 which is relatively strong at 2 tailed significance of 0.000 which is below 0.01 level of significance. The findings of this study correlates with the findings of a study by Rayport and Benard (2001) who discovered that most cost reduction technologies foster improved organizational performance. What all sustaining technologies have in common is that they improve the performance of established products, along dimensions of performance that mainstream customers in major markets have historically valued. Machinery technology involves therefore the adoption of using the modern machinery to improve performance of manufacturing firms at relatively lower costs due to their performance efficiencies.

Regression:

The study did regression on quantitative data between effects of cost reduction on tea factories project performance and presented the findings in the Table 4:3.

Table 4.3: Coefficients^a Determination of effect of cost reduction on tea factories project performance

Model 1	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	3.976	.182		12.856	.000
effect of cost reduction	.093	.069	.276	1.462	.149

a. Dependent Variable: tea factories project performance

Table 4:3 provides the information needed to predict tea factories project performance from effect of cost reduction on. Both the constant and cost reduction contributes significantly to the model. The regression equation is presented as follows; $(Y) = 3.976 + 0.093X_2$

Model Summary:

The model summary between cost reductions on tea factories project performance is presented in Table 4.4.

Table 4.4: Model Summary of cost reduction on tea factories project performance

Model 1	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.363 ^a	.146	.073	.493
a. Predictors: (Constant), tea factories project performance				

Table 4:4 provides the R and R² value. The R value is 0.363, which represents the simple correlation. It indicates an average degree of correlation. The R² value indicates how much of the dependent variable, "tea factories project performance", can be explained by the independent variable, "cost reduction". In this case, 14.6 percent can be explained, which is relatively significant.

Hypothesis testing

The null hypothesis H₀₂: Cost reduction does not have significant effect on tea factories project performance in Trans-Nzoia County: *is rejected* Therefore, Cost reduction does have significant effect on tea factories project performance in Trans-Nzoia County.

5. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS:**Effect of cost reduction on tea factories project performance in Trans-Nzoia County:**

The findings showed that majority disagreed that there is a reduction of scrap or waste and shorter lead times when technology is used effectively in the factories leading to high profits and that agreed that issues of cost are critical in the modern business operations as they can positively or negatively impact on project performance. The findings indicated majority agreed that computerization of tea collection process at the buying centres was implemented to enhance accountability and accuracy of records as a way of reducing operational costs, and enhancing information sharing among all stakeholders. Finally, the results of the study also showed that majority of the respondents disagreed that there is decline/reduction on switching cost and transaction costs involved in announcing orders requests and to receive bids.

RECOMMENDATIONS:

Based on the findings and as evidenced from study findings, capacity maximization plays a key role in enhancing tea factories project performance in Trans-Nzoia County, the study recommends that the management of the tea factories should invest more on latest technology in order to have a reduction of scrap or waste and shorter lead times leading to high profits since issues of cost are critical in the modern business operations as they can positively or negatively impact on project performance. They should also implement Computerization of tea collection process at the buying centres to enhance accountability and accuracy of records and enhancing information sharing among all stakeholders. Management process like order processing, invoicing, customer accounting, and other kind of transaction costs can be handled fast, accurately, and with less paper work and fewer personnel as a way of reducing operational costs hence cost reduction. Beyond speeding up activities and immediately freeing up the time of IT operations staff, automation has added benefit of helping minimize mistakes caused by human error which helps the management of the tea factories in Trans Nzoia County to create the customer loyalty as well as reduce the costs of operation by having consistency in production of final product and being flexible to changes on work environment leading to a high market ranking and achievement of customer satisfaction.

SUGGESTION FOR FURTHER RESEARCH:

The study focused on the effects of technology on tea factories project performance in Trans Nzoia County. One major objective was the influence of cost reduction on projects performance. Similar study on factors influencing tea factories project performance in various counties needs to be done in an environment where the selected factors in this study have been actively practiced for a period of time. This will help in ascertaining the validity of the findings obtained in this research. Similarly, different models apart from regression analysis need to be applied to further in-depth understanding of the relationships between the variables being studied.

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