



EFFECT OF TOTAL PRODUCTIVE MAINTENANCE ON MANUFACTURING PERFORMANCE OF FOOD AND NON-ALCOHOLIC BEVERAGE FIRMS IN NAIROBI COUNTY, KENYA

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ABSTRACT

Total Productive Maintenance is a maintenance strategy that aims to overcome the production losses caused by equipment inefficiency. TPM improves production output by increasing not just the sheer quantity produced but reduces the production cost and delivery date. In the food industry, the production process requires the non-stop operation of automatic production line equipment. For sustainability in the market, the factors like product quality, availability and costs are critical. The sector employs about 14% of the total employees in Kenya and had contributed about 10% to the GDP over the past 3 decades. Therefore, this study aimed to establish the effect of total productive maintenance on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County. Specifically, the study sought to establish the effect of equipment optimization and strategic employee empowerment on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County. The study used descriptive research design. The study targeted population and included all the 43 Food and Non-Alcoholic Beverage manufacturing firms in Nairobi County registered members of KAM 2018. The target population for this study was the entire population of 43 Food and Beverage manufacturing firms which were registered members of Kenya Association of Manufacturers (KAM) 2018. The unit of observation comprised operations manager and maintenance managers. Hence, the target population of this study was a total 86 individuals. The study used primary data that was collected using a structured questionnaire. The data was analysed through descriptive statistics and inferential statistics. Mean, frequencies and percentages were used to present the descriptive statistics while correlation and regression analysis comprised the inferential analysis. The study findings were presented through tables. The study findings revealed that both equipment optimization and strategic employee empowerment have a positive and significant effect on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

Key Words: Total Productive Maintenance, manufacturing performance, food and non-alcoholic beverage firms, strategic employee empowerment and equipment optimization

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INTRODUCTION

The production performance function in manufacturing industry is diminished by ineffective equipment that generates losses occasioned by equipment failure, reduced performance and defective products (Seng, Jantan, & Ramayah, 2011). To increase manufacturing productivity, production improvement strategies are employed that aim to minimize input and maximize output (Rajan & Sajumon, 2013). The total productive maintenance (TPM) is a maintenance strategy that aims to overcome the production losses caused by equipment inefficiency (Seng et al., 2005). TPM improves production output by increasing not just the sheer quantity produced but reduces the production cost and delivery date (Nakajima, 2010).

The survival and economic growth for any country around the globe basically depends on the manufacturing excellence (Singh & Khanduja, 2010). Stiff global market challenges have forced manufacturing companies to implement various production strategies with an aim of meeting the needs of ever-changing market demand. In 1971, Japan food manufacturing industry introduced TPM to respond to the maintenance problems that the manufacturing environment was facing (Li, 2011). According to Inauen, & Wicki, (2011), the Japanese manufacturing firms introduced TPM strategy mainly to improve equipment productivity. According to Jain, (2014) in China, the implementation of good equipment maintenance systems among manufacturing industries improves productivity, thus satisfying customer requirements. Gupta & Garg, (2012) argue that efficient and effective production in manufacturing sector can be achieved by ensuring that there is no equipment breakdown, stoppages or failures during the production process.

The production process in manufacturing industries such as food and non-alcoholic beverage firms is required to be a non-stop operation of automatic production line equipment (Karande, & Chakraborty, 2013). According to Liberopoulos & Tsarouhas, (2012), equipment failure results to

stoppage in a production line thus reducing production rate as well as affecting the quality of products processed. Some of the basic parameters considered by food and non-alcoholic beverage manufacturing firm for market sustainability include product quality, availability and costs. According to Ndicu, (2015), the Kenyan manufacturing sector is a major driver of the economy and has a huge potential to generate the much-needed employment opportunities for the expanding labour force. It is comprised of micro, small and large industries as classified by the number of employees and the amount of capital invested. It employs about 14% of the total employees in Kenya and has contributed about 10% to the GDP over the past 3 decades (Kenya National Bureau of Statistic (KNBS), 2018).

The implementation of TPM practices such as good equipment maintenance systems among manufacturing industries improves productivity, thus satisfying customer requirements. Efficient and effective production in manufacturing sector can be achieved by ensuring that there is no equipment breakdown, stoppages or failures during the production process. Employee empowerment enhances teamwork in any organization; empowered employees can enable the organization to enhance consumer loyalty, to build profitability, increased quality and lower costs. Making empowered groups with all the immediate data, control, acknowledgment, reward and training, is most likely to produce responsible teams that will effectively implement strategies to achieve goals of the company. Employee empowerment fosters a spirit of team work within the organization and uplifts the image of the organization. Hence, this study was conducted to establish the effect of total productive maintenance on manufacturing performance of food and non-alcoholic beverage firms in Kenya.

Statement of the Problem

The food and beverage firms in Kenya is a part of the manufacturing sector that contributes directly more than 29.5% of Gross Domestic Product (GDP)

and 60% of export earnings. In addition, the report also indicates that sector also provides employment to 75% of the Kenyan youth population (Kenya National Bureau of Statistics, (2014). Despite the significant importance of sector to the Kenyan economy, the industry continues to experience tremendous challenges in ensuring their products is delivered to customers on time.

The growth in the food and beverage sector slowed in 2013 to 2.9 percent from the previous 4.2 percent in 2012; this was partly due to the high frequency of machine breakdowns of the major processing plants (KAM, 2013). The production of food products registered a 0.3 per cent decline in 2012 after experiencing a 1.6 per cent decline in 2011. During the period 2011/12, production of meat and meat products rose by 12.3 per cent. Vegetables oils and fats; and grain milling products went up by 7.5 and 6.4 per cent respectively.

In Kenya, plant maintenance has been a major problem because of the traditional misconception of maintenance being viewed as an operational expense to be minimized and not as an investment aimed at increasing process reliability (Braglia, 2006). The estimated cost of maintenance ranges between 15 and 40 per cent of production costs (Dunn, 1987) with an average of 28% (Mobley, 1990). In order for food and non-alcoholic beverage firms in Kenya to survive, functional competitive strategies are required. With a demonstration of some food and beverage companies collapsing in the last ten years, there is perhaps a need to deal with this risk of increased local and global competition, there is also a need for food and beverage companies to radically rethink on their strategies and focus on reduction of operational costs (Molonket *et al.*, 2014). Faced with the phenomenon of globalization, equipment maintenance becomes focused under the vision of quality and productivity management. In this sense, the adoption of a model of strategic maintenance management such as TPM has been increasingly accepted in industrial organizations ((Bartz *et al.*, 2014).

Similarly, past studies conducted on this field have presented conceptual and contextual research gaps, for instance a study by Sharma *et al.*, (2006) in India on issues related with TPM implementation in Indian manufacturing firm revealed that implementation of TPM in Indian manufacturing systems leads to efficient and effective production. In Brazil, Bartz *et al.* (2014) a study examined the implementation of a maintenance management model based on TPM in a production line of a metallurgical company. Ateka (2013) examined the adoption of TPM practices in large manufacturing firms located in Mombasa County. None of the previous studies highlighted the effect of total productive maintenance on manufacturing performance of food and non-alcoholic beverage firms in Kenya. The resulting conceptual and contextual research gaps therefore motivated this study that sought to establish the effect of equipment optimization and strategic employee empowerment on manufacturing performance of food and non-alcoholic beverage firms in Kenya.

Study Objectives

The study main objective was determine the effect of total productive maintenance on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County, Kenya. The specific objectives were:-

- Establish the effect of equipment optimization on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County
- Determine the effect of strategic employee empowerment on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County

LITERATURE REVIEW

Theoretical Review

The Delta Model Theory

The Delta model was proposed by Arnolodo, Hax and Dean Wilde II in 2003 with an aim of creating a strong bond between the customer and the company. In Delta Model, the customer is at the center of management. The model inspects all the

available primary possibilities to create customer bonding, it advocates on how to link a business strategy with implementation through the association of adaptive processes. According to Hax, (2003), the model was formulated with an aim to allow the firms to stop centering so strongly on competitors but to focus their strategies more on their customer.

The figure 1 shows how the model can be illustrated in a strategic triangle. The three points of delta model triangle are system lock-in, total customer solutions and product positioning also known as best product strategy. The system lock- in mainly aids the firm to attain market dominance, majorly its centered on the entire system economics instead of product-centered economics, which makes it very sustainable. The total customer solution is all about building the customer cooperation, and this helps the firm to achieve customer share. The product positioning allows the firm to get the competitive edge, thus increasing market share. The three discussed strategic points enables manufacturing firms to see strategic positions that can act as new sources of profit.

The Delta model does not focus on competition unlike Porter's five forces. Palgrave, (2001) argued that Porter's forces is bargaining power of customer commonly referred as haggling, whereas the Delta model theory aims at building a relationship

between the company and the customer, in this sense the customers are not seen as competitors. Hence the negative aspect of the Delta model is price, valuing a customer first, and building an immense strong customer rapport that might mean the company will struggle to increase prices in near future.

The Delta model theory is relevant to this study since the product positioning strategy rests on the classical form of competition that dictates that the only way to win is through low cost production. The best product strategy enhances low cost production, effective equipment optimization and maintenance to protect firm investment and it also improves productivity by minimizing equipment downtime, extends equipment life, reduce energy and other operating costs and optimizing performance (Nakajima, 2010). The model is also relevant to this study as total customer solutions can be linked to the strategic employee empowerment. Empowering employees within a firm develops teamwork; it also enhances consumer loyalty to a particular firm, to build profitability, increment quality and lower costs (Monari, 2007). The employees who realize the support, empowerment, opportunities and recognition provided by the organization will dedicate their effort, time and energy to service customers and to achieve the objectives of the organization.

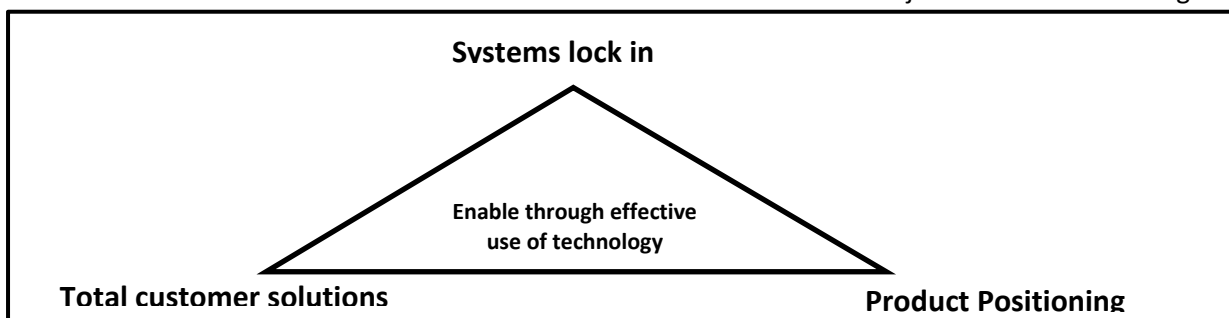


Figure 1: Three Distinct Strategic Positions

Variables Literature Review

Equipment optimization and Manufacturing Performance

The major capital cost of manufacturing sector is equipment and machinery, effective equipment

optimization and maintenance helps to protect the firm from investing in maintenance costs (Karande, & Chakraborty, 2013). The effective equipment maintenance also improves firm productivity by minimizing equipment downtime, extending equipment life, and reducing energy and other

operating costs. The implementation of good equipment maintenance systems among manufacturing industries improves productivity, thus satisfying customer requirements. Efficient and effective production in manufacturing sector can be achieved by ensuring that there is no equipment breakdown, stoppages or failures during the production process. Wang, (2005) in China also argued that equipment output can be maximized by reducing the major causes of equipment ineffectiveness and failure.

In manufacturing companies, the adoption of TPM activities secures the physical enhancement of personnel, equipment, environment and the entire company. According to Kay, (2012), TPM improves equipment usefulness, enhances zero equipment failures, and ensures equipment zero breakdown, zero quality defects and zero industrial accidents. Jeong & Phillips, (2001) argue that majority of manufacturing firms incur equipment losses daily, and TPM strategies are useful in identification of these losses and making improvements through Overall Equipment Effectiveness (OEE). According to Gosavi, (2006), elimination of equipment breakdowns, defects and accidents improves equipment operation rates, reduces operation costs, and minimizes inventory thus increasing labour productivity. Focused improvement aims at improving the equipment effectiveness in any organization. Focused improvement refers to small and continuous equipment improvements and in some cases they are more effective than one big improvement. The focused improvement reduces losses that lower equipment efficiency.

Strategic Employee Empowerment and Manufacturing Performance

Employee empowerment plays a substantial role in the success and survival abilities of the organization in this era of globalization. According to Tsala, (2008) empowerment also allows all employees to use their creative abilities to improve the organizational performance and quality of their own work life, by empowering employees, major opportunities for costs reduction and customer

dissatisfaction can be identified (Monica, 2006). According to Mobley, (2004), employee empowerment enhances teamwork in any organization; empowered employees can enable the organization to enhance consumer loyalty, to build profitability, increment quality and lower costs.

Making empowered groups with all the immediate data, control, acknowledgment, reward and training, is most likely to produce responsible teams that will effectively implement strategies to achieve goals of the company (Monari, 2007).

Employee empowerment fosters a spirit of team work within the organization and uplifts the image of the organization. Employees who realize the support, empowerment, opportunities and recognition provided by the organization will dedicate their effort, time and energy to service customers and to achieve the objectives of the organization.

According to Wagner, and Harter, (2014), training of employees encourages them to participate more actively by helping raise their confidence level. Employee training includes activities such as total quality, decision making, customer care relations models and employee relations. The training given to employees for upgrading the operation and maintenance skills, preparation of training calendar, kick-off of the system for training, and evaluation of activities helps to realize increased manufacturing productivity (Wakjira & Singh, 2012).

Autonomous maintenance aims at developing operators who are able to take care of small maintenance tasks, thus freeing up the skilled maintenance personnel to spend time on repairs that require more expertise (Robinson & Ginder, 1995). Autonomous maintenance involves simple activities such as cleaning, lubrication, tightening of loose bolts and visual inspection (Wakjira & Singh, 2012) and aims at maintaining or restoring the new condition of the machines. Therefore, the performance of employee in organization mostly depends on the organizational support and developmental activities such as training and

teamwork as it empowers them to convey top notch administration to clients (Mobley, 2004).

Empirical Literature Review

Equipment optimization and Manufacturing Performance

In Sweden, Alsyof (2009) studied equipment maintenance practices in Swedish industry. The study used a cross-sectional survey method. The target population was 100 employees. The study results revealed that the role of equipment maintenance in Swedish manufacturing industry was not highly recognized. The study findings revealed that there was a need for the Swedish industry to adopt TPM strategies such as early equipment maintenance concepts so as to enhance productivity.

Spencer, (2015) study investigated how Total Productive Management affects the performance of the Kenya seed industry. Descriptive survey design method was used. The survey was cross sectional in nature since it covered a sample of 47 companies in various segments of the Kenya seed industry. The study used primary data that captured using structured questionnaires. The study also used secondary data that was collected from the company archives. The study findings showed that implementation of TPM practices in an organization not only improves the operating performance but also the profitability. Suzuki, (2012) study on focused improvement and equipment maintenance revealed that focused improvement activities maximizes the overall equipment effectiveness, and production processes through uncompromising elimination of losses and improvement of performance. It was also noted small improvements reduce losses that can lower efficiency.

Strategic Employee Empowerment and Manufacturing Performance

Induswe, (2013) conducted a study to establish success factors and benefits of implementing Total Productive Management (TPM) in large manufacturing firms in Kenya. A cross-sectional survey design was used. The study target

population was 201 large manufacturing firms in Nairobi. The study used primary data that was collected using questionnaires. The study used descriptive findings revealed that the success factors for the implementation of TPM in large manufacturing firms were support from the shop floor union staff and basic maintenance skills training of operators.

A study by Ashayeri, (2007) on implementation of TPM in large manufacturing firms revealed that poor maintenance competencies function severely affects firm competitiveness by reducing productivity throughput; it also increases the firm inventory, thus leading to poor due-date performance. In Libya Graisa & Al Habaibeh (2011) investigated maintenance and production problems in the cement industry with an emphasis on the future implementation of TPM practices. The study results revealed that a lack of training and personal development program of four cement factories led to low productivity.

METHODOLOGY

The study employed a descriptive survey design. According to Cooper & Schindler (2006) assert that descriptive research design assists the researcher to describe how various behaviors and events happen. The study targeted the entire population of 43 food and non-alcoholic beverage firms in Nairobi County registered members of Kenya Association of Manufacturers (KAM, 2018). The unit of observation comprised the operation manager and maintenance manager. The study adopted a census survey approach for data collection as the population of the study was small (Zhang, 2009). The study also used a multivariate regression model to establish the effect of the independent on the dependent variable. A regression model was used to establish the relationship between the study variables. The model was as indicated:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon$$

Where Y – Manufacturing performance of food and non-alcoholic beverage firms, X1 – equipment optimization, X2 - strategic employee

empowerment, ε – Is the error term' and $\beta_i = 1 \dots 2$ are the coefficients of the predictor variables

RESULTS

Descriptive Results of the Study

Equipment Optimization and Manufacturing Performance

The first objective of the study was to establish the effect of equipment optimization on manufacturing performance of food and non-alcoholic beverage firms in Nairobi county Kenya. The respondents were asked to describe the maintenance philosophy of their organization. The results in table 1 revealed that majority 32.3% of the respondents confirmed

that the maintenance philosophy of their company was proactive, 24.2% was somewhat proactive, and 16.1% were not aware of the maintenance philosophy of their organization. A total of 37.4% of the study respondents revealed that the maintenance philosophy of their organization was reactive. This study results implied that majority of food and beverage firms had adopted proactive maintenance philosophy. According to Karande, & Chakraborty, (2013), proactive maintenance in mechanical machinery is helpful in detecting and eradication of machine failure root causes such as wrong lubricant, contaminated lubricant, botched repaired and contaminated lubricant.

Table 1: Maintenance philosophy of the organization

	Frequency	Percent
Reactive	10	16.1
somewhat Reactive	7	11.3
Neither Reactive nor proactive	10	16.1
somewhat proactive	15	24.2
proactive	20	32.3

The respondents were further asked to rate extent to which they agreed with the statements concerning the effect of equipment optimization on manufacturing performance of food and non-alcoholic beverage companies in Nairobi, Kenya. The study results were as indicated in the table 1. The findings indicated that a total of 74.2% of the respondents agreed that the company monitor equipment availability through operating time, scheduled downtime and unscheduled downtime, a total 9.7% of the respondents disagreed while 16.1% of respondents neither disagreed nor agreed with the statement. The study findings also revealed that the majority 75% of respondents agreed that their company monitor equipment quality by comparing the total units produced against the defective units produced, 15.2% were not sure while 9.6% disagreed with the statement.

On whether the use information gathered from the equipment's to identify and prioritize maintenance actions, a total of 82.2% of the respondents agreed, 8% disagreed while 9.8% of the respondents were

not sure with the statement. Those who agreed and strongly agreed that the company continuously applied effort to improve equipment capacity, uptime and production cycle time were 1.6% and 59.7% respectively, a total of 29.1% of the respondents disagreed with the statement while only 9.6% were neutral. The study results further revealed that the majority 58.1% of the respondent strongly agreed that they investigate weaknesses in existing equipment with the aim of improving future designs of new equipment, 4.2% agreed, a total of 30.6% of the respondents disagreed with the statement while only 7.1% were neutral. Lastly, the findings revealed that the majority 72.6% of respondents agreed that members of the firm are part of the design team during the planning and construction of new equipment. Those who disagreed with were 18.2% and only 9.2% neither agreed nor disagreed with the statement.

On average, it was concluded that the majority of respondents agreed with the statements concerning the effect of equipment optimization on

manufacturing performance of food and non-alcoholic beverage companies in Nairobi, Kenya as indicated by average mean value 4.06. The variation in the responses was also small as indicated by the average standard deviation value of 1.33. The findings also concurs with the Gosavi, (2006), study findings that revealed elimination of equipment breakdowns, defects and accidents improves equipment operation rates, reduces operation costs, and minimizes inventory thus increasing labor

productivity. The results of good equipment management were high level of performance, reliability, and fewer production process interruptions, and lower repair costs, elimination of premature equipment replacement and increased safety of both workers and equipment. Good equipment management practices include asset inventory control, maintenance schedules, equipment task allocation, equipment repair costs and records on equipment utilization (Afefy, 2013).

Table 2: Equipment Optimization and Manufacturing Performance

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std Dev
I monitor equipment availability through operating time, scheduled downtime and unscheduled downtime	3.2%	6.5%	16.1%	14.5%	59.7%	4.21	1.13
I compare the total units produced against the defective units produced by equipment on an ongoing basis	4.8%	4.8%	15.2%	12.3%	62.9%	4.23	1.18
I use information gathered from the equipment's to identify and prioritize maintenance actions	4.8%	3.2%	9.8%	14.5%	67.7%	4.37	1.10
I continuously apply effort to improve equipment capacity, uptime and production cycle time	21.0%	8.1%	9.6%	1.6%	59.7%	3.71	1.69
I investigate weaknesses in the equipment with the aim of improving future designs of new equipment	12.9%	17.7%	7.1%	4.2%	58.1%	3.76	1.59
Members of our firm are part of the design team during the planning and construction of new equipment	6.5%	11.7%	9.2%	11.3%	61.3%	4.11	1.31
Average						4.06	1.33

Strategic Employee Empowerment and Manufacturing Performance

The study sought to determine the effect of employee strategic empowerment on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County, Kenya. The respondents were asked to indicate if their organizations do outsource maintenance activities. The results in table 3 indicated that the majority

66.1% of the study respondents agreed that their company do outsourcing of maintenance activities, 27.4% disagreed while only 6.5% of the respondents were not sure if their organizations do outsource maintenance activities. The outsourcing of maintenance activities allows person to bring skills and talents, knowledge and experience into the industry which can be applied in different ways and situations (Mendelson, 2000).

Table 3: Outsourcing of maintenance activities

	Frequency	Percent
Yes	41	66.1
No	17	27.4
Not sure	4	6.5

The respondents were also asked to rate the extent to which they agreed with the statements concerning the effect of strategic employee empowerment on manufacturing performance of

food and non-alcoholic beverage companies in Nairobi, Kenya. The study results were as indicated in the table 4.

Table 4: Strategic Employee Empowerment and Manufacturing Performance

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std Dev
Equipment operators accept and share responsibility with their maintenance counterparts for the performance and status of their equipment	8.2%	7.3%	4.5%	31.6%	48.4%	4.03	1.27
Machine operators are involved in the maintenance routines and continuous improvement activities	8.0%	6.5%	3.2%	38.9%	45.4%	4.08	1.23
We operate through small groups which are made up of members from different sections of the organization	16.1%	6.3%	3.4%	27.0%	47.2%	3.84	1.50
Groups of individuals are tasked with achieving the firms set targets	12.9%	6.5%	4.8%	25.8%	50.0%	3.94	1.41
I am trained on skills that are relevant for personal development and achievement the firm's goals and objectives	11.3%	8.1%	5.8%	38.0%	36.8%	3.92	1.37
There is a training plan that seeks to impart employees with relevant skills	15.3%	12.4%	16.5%	27.4%	28.4%	3.95	1.36
Average						3.96	1.36

The study findings indicated that majority of the respondents, 48.4% strongly agreed that the equipment operators accept and share responsibility with their maintenance counterparts for the performance and status of their equipment, 31.6% agreed, total of 15.5% of the respondents disagreed while only 4.5% of the respondents were neutral with the statement. The majority total 82.3% of the respondents agreed that the machine operators are involved in the maintenance routines and continuous improvement activities, 14.5% of the respondents disagreed while only 3.2% of the respondents were not sure with the statement.

The study findings further revealed that the majority 47.2% of respondents strongly agreed that the company operate through small groups which are made up of members from different sections of the organization, 27.0% of the respondents agreed, 16.1% strongly disagreed, 6.3% disagreed while only 3.4% were neutral about the statement.

On whether groups of individuals are tasked with achieving the firms set targets, the majority 75.8% of respondents agreed, a total of 19.4% disagreed while only 4.8% of respondents neither agreed nor disagreed with the statement. The total number of respondents who agreed that employees are

trained on skills that are relevant for personal development and achieving the firm's goals and objectives were 74.8% respondents, 11.3% strongly disagreed, 8.1% of the respondents disagreed and only 5.8% of the study respondents were neutral with the statement. Lastly, a total of 55.8% of the respondents also agreed that the company had a training plan that seeks to impart employees with relevant skills while 27.7% disagreed. Those who were neutral were 16.5%.

The mean average of 3.96 indicated that the majority of the respondents agreed with statements concerning the effect of employee empowerment on manufacturing performance of food and non-alcoholic beverage companies in Nairobi, Kenya. The variation in the responses was also small as shown by the average standard deviation value 1.36. The study findings were consistent with Mobley, (2004) study results that revealed employee empowerment enhances teamwork in any organization; empowered employees can enable the organization to enhance consumer loyalty, to build profitability, increment quality and lower costs. Making empowered groups with all the immediate data, control, acknowledgment, reward and training, is most likely to produce responsible teams that will effectively implement strategies to achieve goals of the

company. Employee empowerment fosters a spirit of team work within the organization and uplifts the image of the organization. Employees who realize the support, empowerment, opportunities and recognition provided by the organization will dedicate their effort, time and energy to service customers and to achieve the objectives of the organization.

Inferential Analysis of TPM on manufacturing performance

The study further employed a linear regression and correlation analysis to establish the effect of total production management on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County, Kenya.

Correlation of variables

The correlation analysis was used in this study to establish the association among the variables that were used in the study. The data used in this study was discrete; hence a Pearson correlation was used. The correlation was used to indicate the direction in one variable if another variable changes. The strength of the association increases as the value approaches either negative 1 or positive 1. The study results in Table 5 presented the correlation findings.

Table 5: Correlation Analysis

		Equipment Optimization	Strategic Employee Empowerment
Equipment Optimization	Pearson Correlation Sig. (2-tailed) N		
Strategic Employee Empowerment	Pearson Correlation Sig. (2-tailed) N	.263* 0.039 63	
Manufacturing Performance	Pearson Correlation Sig. (2-tailed) N	0.495** 0.001 63	0.488** 0.001 63

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

* Correlation is significant at the 0.05 level (2-tailed).

Regression Analysis Results

Effect of equipment optimization on manufacturing performance

The first objective was to establish the effect of equipment optimization on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

The first hypothesis was;

H_{01} Equipment optimization doesn't have significant effect on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

The criteria was set such that the study accepts the hypothesis if the value $\beta \neq 0$

Simple regression $Y = \alpha + \beta_1 X_1 + \epsilon$ where Y was the manufacturing performance of food and non-alcoholic beverage firms in Nairobi county α was the Y-intercept, X_1 was equipment optimization, β_1 was the beta value and ϵ is the standard error value. The mean equipment optimization (X_1) was regressed with the mean of manufacturing performance of food and non-alcoholic beverage firms in Nairobi County (Y) through simple regression. The interpretation of the results involved using a significance of R^2 and a regression coefficient at 95.0% confidence level. Summing of results was as presented.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.720	0.518	0.51	0.4247

Predictors: (Constant), Equipment-optimization

The findings of the model summary presented in Table 6 revealed $R=0.720$ which implied there was a strong association between equipment optimization and manufacturing performance of food and non-alcoholic beverage firms in Nairobi county. The findings further showed an $R^2=0.518$

which also implied that equipment optimization accounted for 51.8% of the variation in manufacturing performance of food and non-alcoholic beverage firms in Nairobi county other factors held constant.

Table 7: Analysis of Variance (Model Significance)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	41.708	1	41.708	45.411	0.000
Residual	38.851	61	0.648		
Total	80.559	62			

Dependent Variable: Manufacturing-Performance

Predictors: (Constant), Equipment-optimization

The analysis of variance was employed to test the goodness of fit of the model used to fit the independent variable (equipment optimization) and dependent variable (manufacturing performance of food and non-alcoholic beverage firms in Nairobi County). The results revealed f-statistic = 45.411,

with $p=0.000$ which was less 0.05. These findings implied that model had a good fit which further confirmed that equipment optimization was a good predictor of manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

Table 8: Regression coefficients

	B	Std. Error	Beta	t	Sig.
(Constant)	1.882	0.575		3.274	0.000
Mean-Equipment-optimization	0.474	0.137	0.406	3.469	0.001

Dependent Variable: Mean-Manufacturing-Performance

The results of table 8 presented the finding of beta coefficients of equipment optimization. The results revealed a beta coefficients of 0.474 with a corresponding $p=0.001$ which was less than 0.05. The findings implied that there is a positive and significant relationship between equipment optimization and manufacturing performance of food and non-alcoholic beverage firms in Nairobi County. The findings implied that a unit increase in equipment optimization would lead to 0.474 units increase in manufacturing performance of food and non-alcoholic beverage firms in Nairobi County. The null hypothesis was rejected since the relationship between equipment optimization and manufacturing performance of food and non-alcoholic beverage firms in Nairobi County was positive and significant. The findings of the study were consistent with that of Alsyouf (2009) who revealed that small improvements are more effective than just one big improvement if they are continuous, and also small improvements reduce losses that can lower efficiency. The implementation of good equipment maintenance systems among manufacturing industries improves productivity, thus satisfying customer requirements. Efficient and effective production in manufacturing sector can be achieved by ensuring that there is no equipment breakdown, stoppages or failures during the production process. Wang, (2005) in China also argued that equipment output

can be maximized by reducing the major causes of equipment ineffectiveness and failure.

Effect of strategic employee empowerment on manufacturing performance

The second objective was to determine the effect of strategic employee empowerment on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

The second hypothesis was;

H₀₂ Strategic employee empowerment doesn't have a significant effect on manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

The criteria was set such that the study accepts the hypothesis if the value $\beta \neq 0$

Simple regression $Y=\alpha+\beta_1X_1+\epsilon$ where Y was the manufacturing performance of food and non-alcoholic beverage firms in Nairobi county α is the Y-intercept, X_1 is strategic employee empowerment, β_1 was the beta value and ϵ was the standard error value. The mean strategic employee empowerment (X_1) was regressed with the mean of manufacturing performance of food and non-alcoholic beverage firms in Nairobi County (Y) through simple regression. The interpretation of the results involved using a significance of R^2 and a regression coefficient at 95.0% confidence level. Summing of results was as presented.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.725	0.526	0.523	0.4438

Predictors: (Constant), Employee Empowerment

The study results of model summary in table 9 revealed that implied there was a strong association between strategic employee empowerment and manufacturing performance of food and non-alcoholic beverage firms in Nairobi County as shown by $R=0.725$. The findings further

showed an $R^2=0.526$ which also implied that strategic employee empowerment accounted for 52.6% of the variation in manufacturing performance of food and non-alcoholic beverage firms in Nairobi county other factors held constant.

Table 10: Analysis of Variance (Model Significance)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	42.078	1	39.991	42.078	0

Residual	38.481	61	0.197
Total	80.559	62	

Dependent Variable: Manufacturing Performance

Predictors: (Constant), Strategic Employee Empowerment

Analysis of variance was employed to test the goodness of fit of the model used to fit the strategic employee empowerment as an independent variable and manufacturing performance of food and non-alcoholic beverage firms in Nairobi County as a dependent variable. The results revealed F-

statistic = 42.078, with $p=0.000$ which was less 0.05. These findings implied that model had a good fit which further confirmed that strategic employee empowerment was a good predictor of manufacturing performance of food and non-alcoholic beverage firms in Nairobi County.

Table 11: Regression coefficients

	B	Std. Error	Beta	t	Sig.
(Constant)	1.476	0.195		7.553	0.000
Strategic Employee Empowerment	0.644	0.045	0.725	14.251	0.000

Table 11 presented the finding of beta coefficients of strategic employee empowerment. The results revealed a beta coefficients of 0.644 with a corresponding $p=0.000$ which was less than 0.05, this implied a positive and significant relationship between strategic employee empowerment and manufacturing performance of food and non-alcoholic beverage firms in Nairobi County. The findings implied that a unit increase in strategic employee empowerment would lead to 0.644 units increase in manufacturing performance of food and non-alcoholic beverage firms in Nairobi County. The null hypothesis was rejected since the relationship between strategic employee empowerment and manufacturing performance of food and non-alcoholic beverage firms in Nairobi County was positive and significant. The study findings were consistent with Mobley, (2004) study results that revealed employee empowerment enhances teamwork in any organization; empowered employees can enable the organization to enhance consumer loyalty, to build profitability, increment quality and lower costs. Making empowered groups with all the immediate data, control, acknowledgment, reward and training, is most likely to produce responsible teams that will effectively implement strategies to achieve goals of the company. Employee empowerment fosters a spirit of team work within the organization and uplifts the

image of the organization. Employees who realize the support, empowerment, opportunities and recognition provided by the organization will dedicate their effort, time and energy to service customers and to achieve the objectives of the organization.

CONCLUSION

The study findings led to the conclusion that an improvement in equipment optimization practices such as monitoring equipment availability through operating time, monitoring the equipment quality by comparing the total units produced against the defective units produced, using the information gathered from the equipment's to identify and prioritize maintenance actions and investigating the weaknesses in existing equipment with the aim of improving future designs of new equipment leads to a significant improvement in manufacturing performance food and non-alcoholic beverage firms in Nairobi County Kenya. The study also concluded that an improvement in strategic employee empowerment practices such as the equipment operators accepting and sharing responsibility with their maintenance counterparts, involving the machine operators in the maintenance routines and the company having a training plan that seeks to impart employees with relevant skills leads to a significant improvement in manufacturing

performance of food and non-alcoholic beverage firms in Nairobi County, Kenya.

Recommendations

The study recommended that in order for food and non-alcoholic beverage firms to enhance their manufacturing performance, there is a need to consider improving their equipment optimization practices such as monitoring equipment availability through operating time and scheduled downtime, monitoring the equipment quality by comparing the total units produced against the defective units produced and using the information gathered from the equipment's to identify and prioritize

maintenance actions. The study also recommended that there was need for food and non-alcoholic beverage firms to focus on improving their employee empowerment strategies such as involving the machine operator routine maintenance and continuous improvement activities, implementing of training plans to impart employees with relevant skills and operating through small groups which are made up of members from different sections of the organization in order to improve their manufacturing performance significantly.

REFERENCES

- Afey H., (2013). Implementation of Total Productive Maintenance and Overall Equipment Effectiveness Evaluation; *International Journal of Mechanical and Mechatronics Engineering (IJMME-IJENS)* Vol 13, No. 01, pp 69-75
- Al-Aboud, F. (2011). The Strategic Information Systems Planning: A Brief Review, *International Journal of Computer Science and Network Security*, vol.11, no.5, pp.179-183.
- Alsyof, O., (2009) An assessment of maintenance management initiatives in the Indian manufacturing industry. *International Journal of Technology, Policy and Management*, 8(3), pp.250-278.
- Barnes, D. (2008). Operations management: *An international perspective*. London: Thomson.
- Bartz *et al.* (2014). The role of the maintenance organization in an integrated management system. *Managerial Auditing Journal*, 17(1/2), pp.20-25.
- Bertrand, M., & Hallock, K. F. (2011). The gender gap in top corporate jobs. *ILR Review*, 55(1), 3-21
- Cooper, D. R., & Schindler, P. S. (2014). *Business Research Methods*. 9th Ed. New Delhi, India: McGraw-Hill Publishing, Co. Ltd
- Dunn, (1987) .Overall Equipment Effectiveness as a Measure of Operational Improvement- A Practical Analysis, *International Journal of Operations & Production Management*, vol.2 iss.12, pp. 1488, 2000
- Gabbar, H.A., Yamashita, H., Suzuki, K. & Shimada, Y., (2003). Computer-aided RCM-based plant maintenance management system. *Robotics and Computer-Integrated Manufacturing*, 19(5), pp.449-458.
- Ghosh, D. & Roy, S., (2009). Maintenance optimization using probabilistic cost-benefit analysis. *Journal of Loss Prevention in the Process Industries*, 22(4), pp.403-407.
- Graisa, T & Al Habaibeh, A., (2011). The Goal: A Process of Ongoing Improvement, North River.
- Hax, Arnoldo (2003). "The Delta Model- A New Framework of Strategy". *Journal of Strategic Management Education*

- Jeong K. & Phillips D.T., (2002). Operational Efficiency and Effectiveness Measurement, *International Journal of Operations & Production Management*, vol.21 no.11, p.g.1404, 2001
- Karande, P., & Chakraborty, S. (2013). Material handling equipment selection using weighted utility additive theory. *Journal of Industrial Engineering*, 2013.
- Kay, M. G. (2012). Material handling equipment. *Fitts Dept. of Industrial and Systems Engineering North Carolina State University*, 65.
- Kenya Association of Manufacturers and Exporters Directory 2013
- Kothari, C. R, (2010) Research Methodology: Methods and Techniques, second revised Edition, New Age International (P) Ltd Publishers New Delhi
- Monari F. (2007), *Factors Influencing Employee Perception Of Empowerment: A Case Study Of The UoN Staff*, Unpublished MBA Thesis, University of Nairobi
- Monica M. (2006). *Operation Strategies in Solid Waste Management: The Case of Nairobi City Council*, Unpublished MBA Thesis, University of Nairobi
- Ndicu, S. (2015). *Efficiency analysis of the agro-processing industry in Kenya*. Thesis, Kenyatta University
- Palgrave, A, (2001). The Delta Project
- Seng, Jantan, & Ramayah, (2011). Organizational performance Management and measurement: *The Lebanese Experience, Economic and social commission of Western Asia, United Nations Department of Economic and social affairs*.
- Sharma *et al.*, (2006). World Class Manufacturing: The Lessons of Simplicity Applied. Free Press, New York.
- Spencer, (2015). Lean manufacturing: context, practice bundles, and performance, *Journal of Operations Management* 21(2), 129-149.
- Suzuki, (2012) 'TPM can go beyond maintenance: excerpt from a case implementation', *Journal of Quality in Maintenance Engineering*, Vol. 11, No. 1, pp.19–42.
- Wagner, R. & Harter, J. (2014). 12: *The great elements of managing*. Washington, D.C.: Gallup Press.
- Wong, C. Y., & Karia, N. (2010). Explaining the competitive advantage of logistics providers: A resource-based view approach. *International Journal of Production Economics* 128, 51-67.