

# **Influence of Technology Capability on Competitive Advantage of Sugar Companies in Western Kenya**

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## **Abstract**

The Kenya sugar industry operate at an average capacity utilization of 50-60% due to technical limitations which make them uncompetitive in the COMESA region putting at stake 25% of the population that depends on the industry. The objective of the study was to determine the influence of technology capability on competitive advantage of sugar companies in Western Kenya and the hypothesis was that there is no significant relationship between technology capability and competitive advantage in sugar companies in Western Kenya. Descriptive and correlational research designs were used. The target population was 727 senior and middle level managers. A sample of 88 respondents was used in the study. Pilot testing of the questionnaire for validity and reliability was done using 10% of the 88 respondents giving 9 participants. Secondary data was obtained from KSB Year Book of Sugar Statistics and AFFA Year Book of Sugar Statistics reports. Out of 88 questionnaires sent out, 64 were received giving a response rate of 73%. Correlation ( $r=0.289$ ,  $p=0.050$ ,  $CL=95\%$ ) and hypothesis ( $X^2$  critical value  $3.84 < X^2$  test statistics  $5.343$ ) analyses established a positive relationship between technology capability and competitive advantage. The conclusion drawn from the study findings is that the companies under study have technology capability limitations. The study recommends that each firm pays more attention to proper technology capability management. Further research should be carried out on the factors influencing factory capacity utilization of the sugar industry in Kenya.

**Key Words:** Technology capability, Competitive Advantage, Factory Capacity Utilization, Factory Time Efficiency

## **Introduction**

In order to achieve a competitive advantage level that not only can at least match those of their business rivals, business organizations have to initially seek understanding as to the relative degree of relationship between their organizational internal resources and competitive advantage. A firm's strategy selection is based on the careful evaluation of its resource and capability portfolios and reflects the market influence (Barney, 1991). Zimbabwe, Malawi, Zambia, Swaziland and South Africa are able to produce sugar at an average operating cost of around US 8-11 cents/lb., compared with 7.5 cents/lb. in Brazil, the world's lowest cost producer. Swaziland, Ethiopia, Madagascar, Malawi, Mauritius, Swaziland, Zambia and Zimbabwe are net exporter of at least 25 percent of their yearly sugar production (FAO). Performance at the level of the factory in Kenya has remained a major limitation to the increased production of sugar and to the growing of more sugarcane (Obonyo, 2004). The rising costs for the processing of sugarcane in Kenya can be associated with: declining sugar recovery rates; under-utilization of factory capacities; rising costs of energy and store consumables; rising maintenance and repair costs (Kaumbutho, Awiti, & Some, 1991). Odek, Kegode and Ochola (2003) indicate that some of the problems affecting the millers in Kenya are due to, inefficient factory operations, State intervention and debt burden. Factories operate at a capacity utilization of 55 to 60 percent because of significant technical and management limitations (KSB, 2010; KSI, 2009). This percentage of factory capacity utilization is low in comparison to world leaders like India where the sugar industry is operating at an average of 113% capacity utilization (Kumar & Arora, 2009).

Factory time efficiency dropped from 79.58% in 2006 to 74.91% in 2008 in comparison to the international set standard of 92% (Mwanaongoro & Imbambi, 2014). Factory Time Efficiency (FTE) in the 2013 calendar year was 82.29% and Overall Time Efficiency (OTE) was 73.57% over the same period. These results are however low compared to the industry standards of 92% and 82% for FTE and OTE respectively (KSB, 2013). In 2009, sugar production costs in Kenya were the highest at USD 415- 500 as compared to Egypt and Swaziland at USD 250-300; Zambia and Malawi at USD 200-260 and Uganda and Tanzania at USD 140-190 (KSI, 2009). Low cost imported sugar depresses prices and production, distorts sugar markets, leads to reduced income for farmers and threatens collapse of the sugar industry in Kenya. Sugarcane is a key crop in Kenya produced mostly by small out-growers. Western and Nyanza regions dominate sugarcane production in Kenya. The population density is very high in these two provinces and the majorities depend on sugarcane. The focus of the study is in these two provinces due to the economic importance of sugarcane in these two provinces. The study was based on Muhoroni, Chemelil, Mumias, Nzoia, South Nyanza, West Kenya Sugar Companies which have been in operation before 2010 because they have the necessary data for the study.

### **Technology capability**

Oruwari, Jev, and Owei (2002) define technology capability as the capability needed to acquire, assimilate, use, adapt, change or create technology. According to Kotha and Swamidass (1998) investments are made each year in advanced manufacturing technology because practitioners perceive a number of benefits attributed directly to their use namely reduced cycle-time, market share growth, progress towards zero-defects, return on investment and focused production. According to Afuah (2002) and Zhou and Wu (2010) when a firm builds its technological capability, it invests substantial resources in research and development (R&D), which involves the discovery of new products, the accumulation of knowledge stores, and the training of technical personnel. A firm's technological capability is developed over time and accumulated through its past experience. Baark, Lau, Lo, and Sharif (2011) survey of 200 manufacturing firms in Hong Kong and the Pearl River Delta region found out that internal sources constitute a major source of innovations that firms use to build technological innovation capabilities.

### **Competitive Advantage**

Competitiveness of a firm is its ability to do better than comparable firms in productivity, sales, market shares, or profitability (Lall, 2001). Competitiveness implies superior performance in productivity growth; which is best reflected in the effective rate of technological innovation in an economy. According Barney (2002) a firm experiences competitive advantages when its actions in an industry or market create economic value and when few competing firms are engaging in similar actions.

### **Statement of the Problem**

Effective factory maintenance is reflected by percentages factory capacity utilization and factory time efficiency. Most factories in Kenya hardly operate above factory capacity utilization of 50-60% due to technical. Factory Time Efficiency (FTE) in the 2013 was 82.29% and Overall Time Efficiency (OTE) was 73.57% in comparison to the country standards of 92% and 82% respectively. The high production costs for processing sugarcane is associated with: low recovery rates; low factory capacity utilization; rising maintenance and repair costs and high costs of investment. Khalaji (2014) study on relationship between technology and competitiveness of sugar industry in India found out that technological developments play a prominent role to achieving competitiveness. The above mentioned problems in Kenya sugar industry arise out of technology related issues. Hence, depressing the performance of the industry and contributing towards increased costs of production. These challenges pose a threat to the Kenya sugar industry competitiveness in the COMESA region putting at stake 25% of the population that depends on the industry. There has been limited research in Kenya on the importance of technology capability on competitive advantage in the sugar industry. The present research on the Influence of technology capability on Competitive Advantage in Sugar Companies in Western Kenya intends to fill this gap and provide new knowledge and a better understanding of the Resource Based View theory through empirical evidence in relation to the Kenyan sugar industry.

### **Research Objective**

The objective of the study was to determine the influence of technology capability on competitive advantage in sugar companies in Western Kenya.

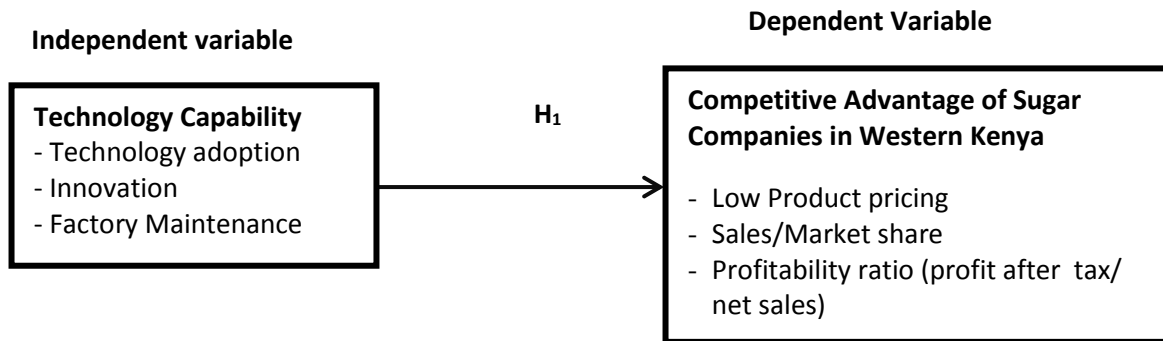
The study also sought and tested the null hypothesis:  $H_0$ : There is no significant relationship between technology capability and competitive advantage in sugar companies in Western Kenya.

### **Theoretical Framework**

The Resource Based View theory (RBV) has emerged as a popular theory of competitive advantage (Barney, 1991; Wernerfelt, 1989). The theory deals with the competitive environment facing the organization and takes an “inside - out” approach, that is, its starting point is the organization’s internal environment. It suggests that the resources possessed by a firm are the primary determinants of its performance, and these may contribute to a sustainable competitive advantage of the firm (Wernerfelt, 1984). As duly noted by Barney (1991), firm’s resources include all assets, capabilities, organizational processes, firm’s attributes, information and knowledge, controlled by a firm that enable the firm to conceive and implement strategies that improve its efficiency and effectiveness. These resources are classified as physical (plant, equipment, geographical locations, finances), organizational and human. The resource based view theory guides the technology capability of a firm.

### **Conceptual framework**

This study looked at the Influence of Technology Capability on Competitive Advantage in Sugar Companies in Western Kenya. The independent variable is the technology capability. The dependent variable is the competitive advantage. The conceptual framework in Figure 1 diagrammatically represents the relationship between the independent and dependent variables.



**Figure 1: Conceptual framework of Technology Capability on Competitive Advantage of Sugar Companies**

### Literature Review

Hermelo and Vassolo (2007) study on “The Determinants of Firm’s Growth: An Empirical Examination” indicated that financial resources, investment in newer technology and diversification by geographic markets were the factors explaining the firm’s growth. The study used data on the small and medium-sized firms of Tucumán one of the states in Argentina. The survey design was used and questionnaires were mailed to 87 firms and usable responses were collected from 34 firms. The sample included firms from the sugar processing, textiles, grain mills, food and beverages, dairy products, paper, meat processing, citrus processing, truck assembling and machinery manufacturing. This information was complemented with information from the National Economic Census of 1993-1994. Regression analysis was used to analyze the data.

Amaeshi, Okorochoa and Akujor (2015) investigated the “Effects of Production Facilities Maintenance on Competitive Advantage of Selected Firms in Nigeria”. The study adopted the descriptive survey method wherein thirty copies of a structured questionnaire on five points Likert scale with Cronbach alpha of 0.703 was used to obtain data from the study population of thirty respondents across the five units (maintenance, production, marketing/store administration, finance and general administration) in the functional units in each of the six case study organizations. The study established that it is more costly to carry out maintenance on a failed system than to prevent the system from failing, owing to repair cost, downtime of equipment, loss of production, customers, market and profit. The study results showed that maintenance of production facilities can improve competitive advantage of manufacturing firms.

Maletic, Maletic, Al-Najjar and Gomiscek (2014) looked at “The role of maintenance in improving company's competitiveness and profitability: a case study in a textile company.” An empirical case study was utilized aiming to provide an understanding of the role of maintenance in improving company's business. The case study was conducted in a Slovenian textile company at weaving machine, one of the company's eight machines. A gap analysis was used in order to address the research problem and to identify potential improvement areas. A five point Likert scale questionnaire was used to gather the required information. Respondents in this study were employees (N=5) from production department, since maintenance is part of it. The most notable empirical results of the case study showed that around 3 % of additional profit could be generated if all unplanned stoppages and loss of quality due to decrease in the productivity would be prevented.

Khalaji (2014) researched on “The Analysis of Technological Capabilities in Sugarcane Industries: Case Study of Salman Farsi Cultivation and Industry Company” in India. A survey method was used and statistical population was composed of 32 senior experts having at least 6 years of job experience at technology units of Salman Farsi Company. Data was collected through questionnaires. According to research results; implementation and absorption of technology had a score of 39.69 % and technology strategy had a score of 52.71 %. The research concluded that of all the factors contributing to achieving better competitive position, technological developments play the most prominent role.

In the Kenyan context, Bulitia, Obonyo, and Ojera (2014) researched on “Moderating Effect of Technology Innovation on the Human Resource Management Practices and Firm Performance: A Study of Manufacturing Firms in Kenya”. A census survey of medium and large manufacturing firms involved in production and marketing of edible oils, soaps and detergents, beverages or sugar registered by the Kenya Association of Manufacturers directory 2012 was used. Data was collected through self-administered questionnaires sent out to 68 firms, of which 50 responded, giving a response rate of 73.5%. A five point Likert scale was used. 82% of the respondents perceived the firm's improvement was attributed to technological innovation. Respondents from both indigenous and multinational firms affirmed that good performance could be associated with technological improvement with a mean score of 4.56 and 4.05 out of the best score of 5.0 respectively.

### **Research Methodology**

The research is a descriptive cross sectional and correlational designs. The target population of the study is composed of 727 senior and middle level managers working in Muhoroni, Chemelil, Mumias, Nzoia, South Nyanza and West Kenya. Yamane (1967) formula (CL= 95%, precision level=  $\pm 10\%$ ) was used to arrive at the sample size of 88 respondents. Baker (1994) 10% of the sample size provided 9 participants to nearest whole figure which was used for pilot testing of the questionnaire for validity and reliability for primary data collection. Secondary data was obtained from KSB Year Book of Sugar Statistics and AFFA Year Book of Sugar Statistics reports. Descriptive statistics was used to summarize both primary and secondary data to enable

meaningful description. Chi-square test was used for hypothesis testing at 0.05% significance level and 95% confidence to determine the relationship and prediction between the independent and dependent variable. Log linear model was used for testing of the objective and correlation analysis was carried out to determine the relationship between the variables.

$\ln(Y_i) = \beta_0 + \beta_1 X_1 + \epsilon$ , where  $Y_i$  is the competitive advantage;  $X_1$  is the technology capability;  $\beta$  are constants and  $\epsilon$  is the error term.

**Results and Discussion**

88 questionnaires were sent out and 64 valid and usable questionnaires were received back giving a response rate of 73%. This is above Mugenda and Mugenda (2003) that a response rate of 50% is adequate for analysis and reporting. The study used both the primary and the secondary data. Frequencies mean and percentages were used to analyze descriptive data, while inferential statistics was used for the testing of hypothesis and correlation analysis for predicting the relationship between the dependent and independent variables. The results are presented in table 1 to 3 where 5= Strongly Agree; 4=Agree; 3=Neutral; 2= Disagree; 1 = strongly disagree, M= Mean and Std= Standard deviation, f= frequency of respondents and % = Percentage of Respondents. The item mean Likert values of 1 to 2.4 refers to disagreement of the respondents to the stated statement, 2.5 to 3.4 refers to the respondents being undecided and 3.5 to 5 refers to the respondents agreeing with the statement.

**Table 1: New technology adoption and competitive advantage**

S/ N	Statement		5	4	3	2	1	M	Std
a)	New technology adoption is to improve the manufacturing process	f	11	20	7	21	5	3.17	1.27
		%	17.2	31.3	10.9	32.8	7.8		
b)	New technology adoption is in the sugarcane transport	f	10	23	10	16	5	3.27	1.25
		%	15.6	35.9	15.6	25	7.8		
c)	New technology adoption to improve product quality	f	9	39	5	8	3	3.67	1.03
		%	14.1	60.9	7.8	12.5	4.7		
d)	New technology adoption to improve productivity	f	13	35	4	10	2	3.73	1.06
		%	20.3	54.7	6.3	15.6	3.1		
e)	New technology adoption to improve existing production process	f	14	31	11	7	1	3.78	0.97
		%	29.1	48.4	17.2	10.9	1.6		
f)	New technology adoption to introduce new production processes	f	12	15	14	14	9	3.11	1.35
		%	18.8	23.4	21.9	21.9	14.1		
g)	New technology adoption to improve competitive advantage in COMESA free trade area	f	15	14	12	14	9	3.19	1.40
		%	23.4	21.9	18.8	21.9	14.1		
h)	New technology adoption in response to government regulations and policies	f	15	32	12	5	0	3.89	0.86
		%	23.4	50	18.8	7.8	0		
<b>Mean of Mean</b>								<b>3.48</b>	

**Table 2: Technology innovation and competitive advantage**

S/ N	Statement		5	4	3	2	1	M	Std
a)	The Organization has allocated enough resources towards technology innovation	f	8	21	8	19	8	3.03	1.28
		%	12.5	32.5	12.5	29.7	12.5		
b)	The Company has policies that support innovation.	f	11	24	11	12	6	3.34	1.24
		%	17.2	37.5	17.2	18.8	9.4		
c)	The Company has framework for filtering and implementing viable innovations.	f	11	19	17	11	6	3.28	1.22
		%	17.2	29.7	26.6	17.2	9.4		
d)	The Company has mentorship program for innovators.	f	7	8	24	15	10	2.80	1.18
		%	10.9	12.5	37.5	23.4	15.6		
e)	Top management is committed towards innovation	f	11	22	16	8	7	3.34	1.22
		%	17.2	34.4	25	12.5	10.9		
f)	Innovation has played a major role in the Organization meeting its revenue target over the past 5 years.	f	15	32	11	6	0	3.87	0.88
		%	23.4	50	17.2	9.4	0		
g)	The Organization has allocated enough resources towards process innovation	f	11	25	5	18	5	3.30	1.27
		%	17.2	39.1	7.8	28.1	7.8		
<b>Mean of Mean</b>								<b>3.28</b>	

**Table 3: Factory maintenance and competitive advantage**

S/ N	Statement		5	4	3	2	1	M	Std
a)	The Organization practices waste reduction maintenance	f	9	22	5	26	2	3.16	1.20
		%	14.1	34.4	7.8	40.6	3.1		
b)	The Organization has strategic maintenance methods for timely replacement of obsolete technology	f	8	18	10	27	1	3.08	1.13
		%	12.5	28.1	15.6	42.2	1.6		
c)	The organization benchmarks for best maintenances practices for its operational benefit	f	11	27	6	19	1	3.44	1.14
		%	17.2	42.2	9.4	29.7	1.6		
d)	The Organization has adopted best maintenance practices to optimize plant availability	f	14	36	2	12	0	3.81	0.99
		%	21.9	56.3	3.1	18.8	0		
<b>Mean of Mean</b>								<b>3.37</b>	



The mean of means for new technology adoption is 3.48 indicating insignificant adoption of new technology. Only the means for items to improve product quality improve productivity, improve existing production process and in response to government regulations and policies are above the mean indicating that these are the areas the industry concentrates on in implementing the new technology. Khalaji (2014) found out that of all the factors contributing to achieving better competitive position, technological developments play the most prominent role. This new technology if adopted in the sugar industry will assist the companies operate effectively and efficiently.

The mean of means for innovation is 3.28 which indicate that the sugar sector is undecided on the course to take as far as technology innovation is concerned. Only Innovation has played a major role in the Organization meeting its revenue target over the past 5 years has a significant mean of 3.87. The firms are not taking advantage of the observation made by Baark, Lau, Lo, and Sharif (2011) that internal sources constitute a major source of innovations that firms use to build technological innovation capabilities and Cabral (2010) that the sustainability of competitive advantage will depend on the extent to which the firm is able to develop capabilities for innovation. Bulitia, Obonyo, and Ojera (2014) asserts that implementation of technology innovations requires consistent focus towards human resource management practices including among others regular training, appraisal and control, and material incentives for enhanced firm's performance.

The mean of means for plant maintenance is 3.37 indicating that the sugar industry has not synchronized its maintenance functions to reap full benefits. Only likert item the organization has adopted best maintenance practices to optimize plant availability has a mean of 3.81. This low mean of means of 3.37 on factory maintenance support the findings by Obonyo (2004) that performance at the level of the factory has remained a major limitation to the increased production of sugar. The sugar industry is missing on the benefits observed by Maletic, Maletic, Al-Najjar and Gomiscek (2014) that around 3 % of additional profit could be generated if all unplanned stoppages and loss of quality due to decrease in the productivity would be prevented. Amaeshi, Okorochoa and Akujor (2015) established that it is more costly to carry out maintenance on a failed system than to prevent the system from failing, owing to repair cost, downtime of equipment, loss of production, customers, market and profit.

The mean of means for new technology adoption, innovation and maintenance is 3.38 showing indecisiveness on management in building technology capability of the sugar industry. These findings support observation by KSB (2010) and KSI (2009) that the industry operates at factory capacity utilization of 55 to 60 percent because of significant technical and management limitations. This further manifests itself in production costs as noted by KSI (2009) that sugar production costs in Kenya were the highest at USD 415- 500 as compared to Egypt and Swaziland at USD 250-300; Zambia and Malawi at USD 200-260 and Uganda and Tanzania at USD 140-190.

Secondary data was obtained from AFFA Year Book of Sugar Statistics (2014), KSB Year Book of Sugar Statistics and the firms themselves in order to analyze the technology capability of these firms. Technology capability of a sugar company may be drilled from its factory operational parameters: factory capacity utilization and factory time efficiency. Factory capacity utilization compares the quantity of sugarcane crushed by a mill in comparison to the designed quantity (capacity). Factory time efficiency compares the hours the factory has been crushing sugarcane in a certain period in comparison to the hours that were available in the period. Table 4 provides data for factory capacity utilization from 2011 to 2014.

**Table 4: Five years' comparative data of factory capacity utilization (%)**

<b>Company</b>	<b>Year 2011</b>	<b>Year 2012</b>	<b>Year 2013</b>	<b>Year 2014</b>	<b>Average%</b>
Chemelil	28.53	29.5	38.3	41.27	<b>34.4</b>
Muhoroni	42.36	50.85	45.92	56.31	<b>48.9</b>
Mumias	64.51	63.24	55.01	51.05	<b>58.5</b>
Nzoia	69.67	75.78	70.11	82.69	<b>74.6</b>
South Nyanza	59.71	54.42	60.35	56.63	<b>57.8</b>
West Kenya	69.97	60.50	79.96	77.55	<b>72.0</b>
<b>Average %</b>	<b>55.79</b>	<b>55.72</b>	<b>58.28</b>	<b>60.92</b>	<b>57.7</b>

**Source:** AFFA Year Book of Sugar Statistics (2014).

The average factory capacity utilization for the firms under study has shown improvement from 55.79% in the year 2011 to 60.92% in 2014. This factory capacity utilization is low in comparison to world leaders like India where the sugar industry is operating at an average of 113% factory capacity utilization (Kumar and Arora, 2009). The second operational parameter that indicates technology capability of a firm is the factory time efficiency. Factory time efficiency provides the percentage time the factory crushed in comparison to the time that was available for crushing. Table 5 provides data on factory crushing hours and stoppage due to factory breakdowns and table 6 shows the factory time efficiency.

**Table 5: Five years' comparative data of stoppage due to factory breakdowns (hrs.)**

<b>Company</b>		<b>Year 2011</b>	<b>Year 2012</b>	<b>Year 2013</b>	<b>Year 2014</b>
Chemelil	Crushing	3,173	2,976	2,626	3,994
	Stoppage	3,329	2,532	2,112	729
Muhoroni	Crushing	3,743	4,042	3,627	4,693
	Stoppage	2,412	2,471	2,151	2,425
Mumias	Crushing	6,066	6,072	5,750	4,524
	Stoppage	742	807	733	688
Nzoia	Crushing	5,347	5,845	5,914	5,087
	Stoppage	1,071	899	1,385	401
South	Crushing	5,811	4,724	5,841	5,366
Nyanza	Stoppage	1,154	893	1,142	1,005
West Kenya	Crushing	6,030	5,957	7,177	5,962
	Stoppage	475	830	788	673

**Source:** AFFA Year Book of Sugar Statistics (2014).

**Table 6: Five years' comparative data of factory time efficiency (%)**

<b>Company</b>	<b>Year 2011</b>	<b>Year 2012</b>	<b>Year 2013</b>	<b>Year 2014</b>	<b>%Average</b>
Chemelil	48.8	54.0	55.4	84.6	<b>60.7</b>
Muhoroni	60.8	62.1	62.8	65.9	<b>62.9</b>
Mumias	89.1	88.3	88.7	86.8	<b>88.2</b>
Nzoia	83.3	86.7	81.0	92.7	<b>85.9</b>
South Nyanza	83.4	84.1	83.6	84.2	<b>83.8</b>
West Kenya	92.7	87.8	90.1	89.9	<b>90.1</b>
<b>Average %</b>	<b>76.3</b>	<b>77.2</b>	<b>76.9</b>	<b>84.0</b>	<b>78.6</b>

**Source:** AFFA Year Book of Sugar Statistics (2014).

Factory time efficiency has been derived from table 5 showing crushing time and factory stoppage hours due to factory breakdowns. The industry set standard is 92% (AFFA, 2014). In most cases the factories are struggling below the set standard of 92% and the average for the industry ranged between 76.3% and 84% for the period under study. If the industry could strive to run at 92% factory time efficiency or above, then the cost of production would be reduced and the firms would make more revenue.

### Logit Regression Analysis

The study conducted a logit regression analysis to measure the relationship between the independent variable and the dependent variable as per objective by estimating the probabilities using the logit function. The capability was categorized into two: 0-weak and 1-strong. The competitive advantage was binary: 0-not competitive and 1-competitive. The output of the analysis is presented in table 7 and fitted into a model.

**Table 7: Logit results for the technology capability**

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Technology Capability	1.204	.529	5.174	1	.023	3.333	1.181	9.406
Constant	-.847	.398	4.523	1	.033	.429		

Odds of competitiveness of sugar companies =  $-0.847 + 1.204x_1 + 0.927$ , Where

$\beta_0 = -0.847$  is the constant

$x_1$  is Technology capability

0.927 is the error term (SE)

The objective was to determine the influence of technology capability on competitive advantage in sugar companies in Western Kenya. The results revealed that companies that had strong technology capability were 3.333 more likely to be competitive compared to those that had weak technology capability

### Correlation analysis of technology capability on competitive advantage

The correlation strengths were interpreted using Cohen (1988) decision rules where 0.1 to 0.3 indicate weak correlation, 0.31 to 0.5 is moderate correlation and greater than 0.5 indicate a strong correlation between the variables.

**Table 8: Correlation results of technology capability and competitive advantage**

			Technology Capability	Competitive Advantage
Spearman's rho	Technology Capability	Correlation Coefficient	1.000	.289*
		Sig. (2-tailed)	.	.010
		n	64	64
	Competitive Advantage	Correlation Coefficient	.289*	1.000
		Sig. (2-tailed)	.010	.
		n	64	64

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

The results established that there was a weak positive relationship between technology capability and competitive advantage ( $r=0.289$ ,  $p=0.050$ ,  $CL=95\%$ ). This meant that if the technological capability is enhanced then competitive advantage would also improve significantly.

### **Hypothesis testing**

**H<sub>0</sub>:** There is no significant relationship between technology capability and competitive advantage in sugar companies in Western Kenya.

Null hypothesis was tested using the Chi-square computed value which was compared with the Chi-square distribution reading and a decision made whether to reject the null hypothesis or fail to reject it. This was done at  $CL=95\%$ ,  $p=0.05\%$  and one degree of freedom (df.).

$\chi^2$  test statistics = 5.343 df. = 1 and  $\chi^2$  critical values = 3.84. Since  $3.84 < 5.343$  (df. = 1), the test statistic falls in the rejection region. Therefore, we reject the null hypothesis and conclude that there is a significant relationship between technology capability and competitive advantage in sugar companies in Western Kenya.

### **Conclusions**

The companies under study have technology capability limitations, are operating at low capacity utilization and factory time efficiency of less than 92% and these factors are negatively affecting the competitiveness of the firms.

### **Limitations**

The data used in this study was collected from sugar firms which were in operation before 2010. Many newer factories have since been erected and these findings may not wholly apply to them. Further, the data used in this study is mainly from State owned sugar firms and they may not apply fully to privately owned sugar firms.

### **Recommendations**

The industry should pay keen attention to importance of new technology, create an environment for technology innovation and constantly evaluate the maintenance strategies for efficient and effective operation of the sugar industry.

### **Areas for further research**

Further research should be carried out on the factors influencing factory capacity utilization of the sugar industry in Kenya.

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