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RE-THINKING ENERGY EFFICIENT TECHNOLOGY IN SUSTAINING COMPETITIVE ADVANTAGE AMONG MANUFACTURERS IN DEVELOPING ECONOMIES

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Abstract

Empirical studies show that technology adoption in developing economies has yielded enormous financial savings and reduction in resource usage. However, the gains of such technology have not been discussed in sustaining competitive advantage strategies. Manufacturing firms in Economies such as Kenya are the highest consumers of both electricity and petroleum products, making it imperative for consideration of efficient technology. The study objective was to assess the effect of implementing energy efficient technology on sustaining competitive advantage. The study adopted a mixed approach, with a survey research design and a study population of 1,459,870 employees among selected manufacturing firms in Nairobi, Kenya. A sample of 399 respondents was selected randomly from the selected. Questionnaires

were used to collect primary data while secondary data was obtained by reviewing previous studies in the area of study. Data analysis was done using descriptive statistics (mean, standard deviation, and frequency distributions). Inferential statistics included correlation for test of association, and regression for test of hypothesis. The study found that energy efficient technology is a significant predictor of competitive advantage; with negative coefficient value of -0.599 an explanatory power of 35.8%. The study revealed that manufacturing companies in developing nations need to re-think its investment on efficient technology, as a means of sustaining competitive advantage. This was noted to have been caused by high capital intensive technology which is beyond the reach of many companies in developing nations, hence slowing its efforts of sustaining competiveness among its rivals.

Keywords: Efficient Technology, Competitive Advantage, Developing Economies, Automation, Energy Management, Sustainable Competitiveness

INTRODUCTION

Taylor (2012) defines energy efficiency as the installation of energy efficient technologies and implementation of practices that are designed to reduce energy wastage and eliminate energy losses in homes and business firms. Manufacturing firms across the world incur huge energy expenses through energy bills. The fundamental question is whether modern manufacturing firms practice energy efficiency or not. If they do, what are the significant benefits arising out of energy efficiency practices? Can these benefits be transferred to other competitive processes? and can the gains assist a firm in sustaining competitive advantage? In modern economies, if the above significant questions are adequately addressed, then a sustainable competitive firm can be fostered. Sustainable competitiveness on the other hand is the firm enhanced development initiatives that enable it to meet its present needs without compromising the ability of its future endeavours to meet other obligations.

In 2013, the U.S. was just 39% efficient in energy use. This implies that 61% of the firms and households did not practice energy efficiency (Fischer, 2013). Fischer (2013) further argued that there was energy wastage stemming from electricity generation (because most power plants in the USA are relatively inefficient) and the transportation sectors (internal-combustion vehicles) are notoriously inefficient, though they were getting better. These findings place a gloom situation on developing economies, where the transportation sector is composed of second-hand vehicles which are not fuel efficient. Bai (2013) observed that 41% of all global firms considered energy management as an extremely important endeavour to their firms.

However, 64% of these global firms focused on carbon reduction and not on universal practice of energy efficiency as a strategy in sustaining all firms' competitive advantages. In addition, cost savings was noted to be the leading driver of all energy efficiency initiatives (Institute of Building Efficiency, 2013).

Bloomberg New Energy Finance, which is a research company based in UK, observed that investments made by most countries and firms are based on the use of clean energy as a measure of ensuring management. Its report focuses on the investments made by nations on clean energy. However, they do not refer to the transfer of such benefits in sustaining competitive advantages (Zindler, 2014). Lacey (2013) stated that developed economies are more concerned with energy management than its production, while this is contrary in developing nations. He refers to the comments made by Laitner, a visiting fellow at the American Council for Energy-Efficient Economy, who noted that in 2010 America expenses on energy management improvements across its sectors has continued to increase by 80% since 2004 (Laitner, 2013). It is further noted energy management focus has been on utilities, manufacturing, construction, appliances, and automobiles. Through energy management in the American economy, Lacey (2013) states that the energy management initiatives have resulted in per capita income increase of 84% since 1950 (Lacey, 2013).

The Climate Leaders Conference held from 2008-2016, have focused primarily on climate change, carbon emission and its reduction (Audrie, 2008) and (Steve, 2016). The conferences noted that despite the improvements in energy management, global energy demand is expected to double by 2050. The conference further observed that global recession has affected Africa heavily; the economic growth and that energy and poverty issues remained as a major concern. Poverty alone has been burdening the continent because its electricity demand has continued to increase, and energy security has tightened as the result of the lack of the required investment and increasing power shortages across the continent. The challenges on energy efficiency are further presented as strategies by (Xia, 2013; Mlamo, 2004) that identified education, training, efficiency standards, appliance labelling, accreditation, regulation, audits, and information sharing as the avenues of enhancing energy efficiency practices. The Department of Environmental Affairs and Tourism in South Africa in 2005 also supported the above recommendations (Government of South Africa, 2005). Such studies consider lack of information, hidden engineering costs, imperfect information for consumers, regulatory failures, and behavioural failures such as self-control problems by the users of energy sources as contributory challenges in sustaining an effective energy efficiency system.

In Kenya, Kirai (2004) presented findings of a study that showed poor uptake of energy efficiency practices by industrial firms. This owed to the fact that there was no assistance given

by government to firms, low involvement by company CEOs, perception of expensive technology, and the size of firm as the challenges facing adoption of energy efficiency practices. Although, there was notable training of over 250 firms in efficiency practices, few firms invested in the exercise. The payback period for such practices was 1 year, 2 months. The study recommended seminars, awareness training, energy audits, and technology upgrades as the measures of promoting energy efficiency practices.

A report by KNBS (2012) showed that manufacturing firms own fleets of vehicles which consume significant amounts of petroleum products and that most of its fleet are not fuel efficient due to age factor. The report shows that most manufacturing firms run inefficient technologies especially in its motor vehicles and machines leading to high cost of petroleum and electricity which are usually influenced by volatile demand and supply factors. The average age of vehicles driven in Kenyan roads is 15 years and their efficiency erodes as it ages. American vehicles have a road lifespan of 11.4 years, European Union is less than 5 years while Japan it is between 7-8 years. In Kenya, the average road usage is double the world standard and three times the average of the most efficient road transport systems (Kenya Motor Industrial Association, 2014). The association asserts that when vehicles get older, they consume more fuel, and become inefficient in energy usage thus increasing operating costs. In their recommendations, they propose the use of the newest possible efficient technologies in their fleet of motor vehicles.

United Nations Environmental Program (UNEP) (2014) further indicated that if Kenya invests in green economy, its national GDP would exceed (12%), or KES 3.6 trillion (equivalent to USD 45 billion) by 2030. Per capita national income would double from KES 39,897 (USD 498.70) to KES 69,702 (USD 871.30), and this is realizable if the country invests only (2%) of its GDP. The report further claims that a green economy increases agricultural yield by (15.5%) from the current yield. This is because agriculture accounts for up to (65%) of national exports. The report also notes that Kenya is already implementing policies and initiatives to move towards a green economy. In energy consumption, the report finds that more green energy investments could produce a (2%) reduction in energy consumption and an expanded supply of electricity. The report made recommendations to the government to consider adopting targeted clean energy solutions for households and institutions, such as energy efficient lighting and appliances; and, making additional investments in renewable energy, such as geothermal, solar, wind and biofuel energy (Njoroge, Zorba &Muia, 2014). However, the transfer of energy efficiency technology gains in sustaining a firm’s competitive advantages is not discussed. This, therefore, provided an impetus for the study to investigate the adoption of a shared energy

efficiency technology in sustaining a firm's competitive positions. However, these efforts have faced numerous challenges which the study sought to investigate.

Energy management is neither visible nor easily measured. However, it improves competitiveness as well as security by expanding the provision of energy (Tromop& Rosenfeld, 2013). International Energy Agency (IEA) provides the following as some of the energy management benefits (IEA, 2013): It leads to better health, improved room temperatures, and reduces respiratory diseases; It increases product market value; It reduces demand for energy from energy management limits and lowers investments needed to install additional energy infrastructure to meet high demand; Companies operating costs and utility decreases and raises firm's profit through reduced operating costs; it can also provide consistency and improvement in quality and output.

Oimeke (2013) noted that the challenges facing energy management practices include; High cost of introducing efficient and cost effective technologies, Lack of awareness, Inadequate incentives, Inappropriate and limited credit and financing mechanisms on equipment, Lack of standards, Lack of codes of practice such as regulations for enforcements and inadequate capacity to promote and monitor penetration of energy management. In overcoming the challenges, it recommends; sensitization campaign, develop energy management standards for equipment's and facilities, introduce energy auditors training curriculum, carry out site inspections and interviewing and licensing energy auditors and audit firms.

The IEA (2010) noted that some of the challenges facing energy management programs include; price distortions, Lack of understanding of Energy Management investments, lack of awareness, lack of sufficient information, the encouragement of energy providers to sell energy rather than invest in cost-effective energy management, Lack of affordable energy management technologies and Insufficient capacities for identification, development implementation and maintaining energy management investments.

The energy management uptake in South Africa has been slow because of low levels of awareness of its benefits, lack of available technologies, and the alternative priorities of companies. In 2005, South Africa introduced energy management in all sectors of energy consumption; the strategy set a national target for energy management of 12% by 2015 (Haw & Hughes, 2007). Kenya has also had initiatives to ensure energy management, but this has not been yielding the required substantive results. This includes the attempt to allocate funds to promote energy management. United Nations Industrial Development Organization (UNIDO) reported in 2013 that the Kenyan government had allocated KES. 2,036,193.03 For the energy management programmes but KES. 598,563.23 were actually released. Though this is a step

towards reducing consumption, this presents a challenge in promoting energy management practices in the sector (UNIDO, 2013). The study by Bennett (2001) agrees with later findings in relation to the challenges faced by African countries.

Statement of the Problem

Petroleum and electricity remain as the two main components of energy sources used by manufacturing companies in Kenya (IEA, 2015). The Institute of Economic Affairs (IEA) (2013) observed that in Kenya, petroleum products are imported both in crude and refined form for which the manufacturing sector remained the second largest consumer of the petroleum products. Due to lack of adequate electricity to support both the manufacturing and the domestic sector, the country operated diesel generators to generate additional electricity during the dry seasons when water levels in the hydro dams run low. The Energy and Environment Partnership (2014) and GOK (2016) found that the main sources of energy in Kenya are wood fuel (68-70%), petroleum (21-22%) which included petrol, diesel, paraffin, and electricity (9%). It argued that the Kenyan industrial sector consumes approximately (60%) of the total electricity generated and because of frequent power outage, company production was always averaged at approximately 9.3% (IEA, 2015). In UK lighting alone is one of the most energy intensive end use by commercial firms, representing over 20% of the nation's electricity consumption (Harrell and Kulkarni, 2004). The report further showed that in Kenya at least 30% of electricity generated is wasted by manufacturing firms causing electricity and petroleum shortages and such firms incur high energy Expenses.

According to the findings by Kenya Institute for Public Policy Research and Analysis (KIPPRA, 2016), some manufactures have migrated to other countries attributing high-energy costs as one of the main contributing factor to their exit. KIPPRA (2016) also showed that Kenyan Manufacturers have been facing stiff competition from companies located in these competing nations owing to their ability to purchase electricity at a lower cost. Ethiopia, Uganda, Egypt and South Africa offered their investors an assurance of dependable and less costly energy as one of the key incentives as compared to the government of Kenya. This has made some of major manufacturing firms in Kenyan firms to exit the Kenyan economy.

The Government of Kenya through the value added tax (VAT) Act of 2013 and its subsequent amendment Act of 2014 exempts importers from value added tax (VAT) and income duty on certain plant and machinery that promote energy efficiency technology. Companies that wish to import solar cells and modules that do not contain diodes, batteries or similar equipment are free from import duty and exempt from VAT (GOK, 2013; GOK, 2014). Photovoltaic (PV) cells and light-emitting diodes, together with wind-powered generating sets that have already

been assembled, are subject to a 5% import duty and 16% VAT. It should also be noted that wind engines (wind mills) are free from import duty and exempt from VAT though costly to purchase. In addition, hydraulic turbines and water wheels are free from import duty but pay 16% VAT. With such taxes, the Kenyan Manufacturers may not stand the chance of importing such technologies for their industries. However, the gains may be harnessed in the long-run.

Study Objective

To examine the effect of energy efficient technology on sustaining competitive advantage among manufacturing firms Kenya.

Research Hypothesis

Implementation of energy efficient technology has no significant effect on sustaining competitive advantage among manufacturing firms in Kenya.

LITERATURE REVIEW

Transient Advantage Theory (TA)

McGrath (2013) argues that business strategies should be formulated in such a manner that it guides the firm's behaviour for a longer period of time. The philosophy states that, since the current business environment is evolving, opportunities continuously arise that can enable a firm to leverage competitive advantage. As such, once other rival firms leverage the competitiveness, the firm will have moved to other strategies-hence making business strategies transient and not permanent. The current study argues that energy management practices are also evolving with newer technologies and innovations, hence the need for a dynamic change of tactic in ensuring that the firm continuously adopts such transient business strategies.

In energy management, Alcott (2005) argued that any management endeavours or improvements made in the use of energy resource leads to increase in total consumption of that resource rather than decrease it (Alcott, 2005). He further posits that with advancement in technological progresses, there is an increase in management of the resource used, with price and income benefits, but consumption increases. However, it can be inferred that, even though there exists a tendency of high consumption of the said resource, manufacturing firms can realize the advantages of economies of scale arising from Expenses reduction, energy savings and increased firm profit. In turn, such phenomenon of increased performance can be as a result of more investment of the accrued benefits from energy management practices in other competitive processes.

Empirical Review

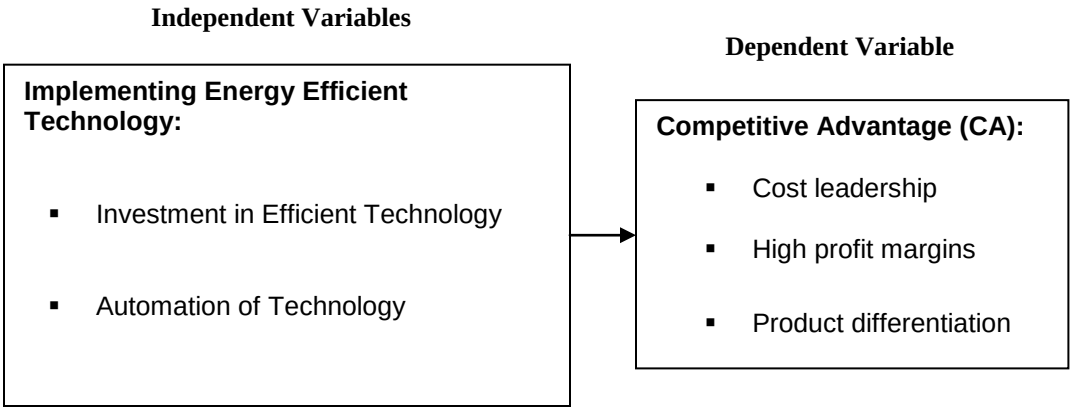
Hartmann and Huhn (2009) observed that energy management in industries can be increased through customized information technology solutions. As such, related innovative information technology software can be applied by industrial related firms so as to monitor its consumptions and usage. In addition, the use of renewable energy such as solar is expected to also increase exponentially by the year 2020. The use of low-consumption combustion engines and energy saving technologies are also expected to be in use globally and that fuel consumption vehicles were expected to fall by 17% by the year 2010. This is also expected to support sustainability initiatives by nations of the world (Victoria, 2007).

UNIDO (2012) observed that technological standards, improvements and maintenance promoted reduction of electricity consumption in China by 20%. As such, it creates additional energy for supply and reduction of energy expenses. This can be replicated in Kenya and manufacturers advised on the significance of technological investments in energy source usage. Backlund et al. (2012) states that a gradual practice of energy management leads to a reduction of operating costs and increases competitiveness and productivity of the company. This revelation, can present greater opportunity for manufacturing firms to enhance its competiveness through cost reductions.

Evaluation by Wilkinson and Kituyi (2006) revealed that an ineffective technology leads to high production costs and thus high product price. As such, companies can reduce such costs by adopting efficient technologies in their production systems and processes. Audrie (2008) revealed that some of the causative factors of high-energy consumption are improper installation and poor maintenance of machinery and apparatus. Friedmann et al. (2008) reported that the use of low-energy technologies, reduction of wattage in electricity bulbs and lamps such as LED were some of the energy management practices that manufacturing firms can institute.

Energy management practices, as noted by NEED (2012), include the use of technology that requires less energy to perform the same function. Energy management practices can also be attained through policy guidelines, and training of users (Ihuthia and Wang'ombe, 2012). It is therefore necessary to point out those actions such as awareness by employees, training, responsiveness, efficient technology use and other form of behaviour change in the use electricity and fuel results in the use of less energy and its conservation and that in implementing new technologies, personnel that introduce such technologies must often serve as both technical developers and implementers for it to be effective (Barton & Kraus, 1985).

Figure 1. Conceptual Framework



Energy Efficient Technology

This is include Investment in Efficient Technology and Automation of Technology adopted by firms that entails; efficient lighting technology, energy efficient engines, automatic lighting sensors, and installation of artificial intelligence to monitor power consumptions. Investment in such technologies ensure that firms monitor their energy usage in order to enhance saving and reduce its Expenses.

RESEARCH METHODOLOGY

Research Design

The study adopted a mixed methods approach. The approach enabled collection of facts and relevant information from respondents regarding the effect of energy management on sustaining competitive advantage among manufacturing firms (Hussey & Hussey, 1997).

The study further utilized survey research design. This enabled the researcher to collect data by sampling respondents selected manufacturing firms in Nairobi Kenya (Hussey & Hussey, 1997).

Population of the Study

KNBS (2014) observed that the manufacturing companies in Nairobi and its environs has approximately 1,459,870. The population was adequate for the study, given that Nairobi region hosts the highest number of manufacturing companies.

Sampling

This study considered a sample of 399 respondents obtained using Yamane (1967) formula selected at 95% confidence level as shown below as adequate.

Data Collection

This study utilized a self-administered questionnaire which was more practical for the study and it ensured that a large amount of data was collected from as many respondents as possible; they are also less time consuming. This method was more suitable for the study since it sought for factual answers and opinions relative to the simple 5-Point Likert scales. Secondary data was retrieved from past studies and related literature such as studies by Kenya Association of Manufacturers, Kenya National Bureau of Statistics annual reports, Energy Regulatory Commission reports, International Energy Agency, Institute of Economic Affairs, United Nations Development Organization, Online Journals, and Unpublished student theses.

Data Analysis and Presentation:

The data was analysed using both descriptive and inferential statistics. It was then presented using Tables and Figures.

FINDINGS

Response Rate

According to American Association for Public Opinion Research (AAPOR, 2010), response rate is the end results or outcome for surveys. A high response rate helps to ensure that the survey results are representative of the survey population (Data Analysis Australia, 2013; Wyse, 2012). The study targeted a sample of 399 respondents. The researcher managed to successfully collect data from 314 of them. This represented a response rate of 78% of the sample size. The researcher considered the response rate to be good enough, since it was above appropriate threshold of 55.6% (Baruch, 1999).

Assessment of Reliability of Study Measures

Table 1. Reliability Estimation

Variable	Cronbach Alpha coefficients
Energy Efficient Technology	0.701

The study measures were found to be highly reliable in that they all had an alpha coefficient greater than the minimum accepted Cronbach's alpha coefficient of 0.70 which was the predetermined cut off point.

Correlation Analysis

Table 2. Correlation Analysis between Energy Efficient Technology and Competitive Advantage

Correlations

		Dependent Variable-Competitive Advantage	Independent Variable-Energy Efficient Technology
Dependent Variable-Competitive Advantage	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	314	
Independent Variable-Energy Efficient Technology	Pearson Correlation	-0.599**	1
	Sig. (2-tailed)	0.000	
	N	314	314

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

From Table 2, Pearson's correlation coefficient is r = -0.599 at p = 0.05) between energy efficient technology and competitive advantage. This implied that there was a strong negative and significant correlation between energy management policy in sustaining competitive advantage. It also implied that, implementation of energy efficient technology improved the competitiveness of a firm at local, national and international markets. The finding is consistent with Hartmann and Huhn (2009) who observed that energy management in industries can be increased through customized information technology solutions and that the use of low-consumption combustion engines and energy saving technologies are also expected to be in use globally and that fuel consumption vehicles were expected to fall by 17% by the year 2010 which will all contribute to reduction in energy consumption, hence lower energy expenses (Victoria, 2007).

The finding also is supported by UNIDO (2012) which argued that technological standards, improvements and maintenance promoted reduction of electricity consumption in China by 20% and this can also be replicated in the manufacturing sector so as to enhance attainment of competitiveness in the sector.

Wilkinson and Kituyi (2006) revealed that an ineffective technology leads to high production costs and thus high product price and this is evidence by the current average energy expenses which stood at 10.5% of total revenues.

Regression Analysis

Table 3. Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.599[a]	0.358	0.356	0.06895	0.358	174.193	1	312	.000

a. Predictors: (Constant), Independent Variable: Energy Efficient Technology

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.828	1	0.828	174.193	0.000[b]
	Residual	1.483	312	0.005		
	Total	2.312	313			

a. Dependent Variable: Dependent Variable-Competitive Advantage

b. Predictors: (Constant), Independent Variable: EET-Energy Efficient Technology

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.675	0.044		105.371	0.000
	Objective 3: EET-Weighted Means for 9 Sub Variables	-0.179	0.014	-0.599	-13.198	0.000

a. Dependent Variable: Dependent Variable-Competitive Advantage

The objective of the study was to examine the effect of implementation of energy efficient technology on sustaining competitive advantage among manufacturing firms. The correlation results as shown in Table 2 revealed a strong and negative relationship which showed that implementing energy management regulations had a negative effect on competitive advantage. The finding was statistically significant at p = 0.05.

In testing, the null hypothesis aggregate mean scores of competitive advantage were regressed on the indicators of energy efficient technology and the relevant results are presented in Table 3. The regression results revealed that there was statistically significant relationship between energy efficient technology and competitive advantage among

manufacturing firms at 5% significance level (p-value = 0.05). From the above regression results, the study therefore rejected the null hypothesis that: Implementation of energy efficient technology has no significant effect on sustaining competitive advantage among manufacturing firms. The regression results showed that a one percentage increase in energy efficient technology led to a 17.9% decrease on competitive advantage This change is significantly not beneficial to the firm; hence the study concluded that energy efficient technology affects the competitiveness of a firm negatively. The study therefore argues that technology investment in developing countries required huge financial investment which erodes the firm's competitiveness in the short run. As such, investment in efficient technology should be carried out with caution by considering the cost implication to the firm. On the other hand investment in efficient technology also does not guarantee benefit if the users of such technology do not adhere to manufacturers requirements and may not guarantee the firm any competitive benefit.

The findings disagreed with the findings by UNIDO (2012) which supported the improvement of technological standards and maintenance of company equipment, apparatus and machines in order to promote reduction of electricity consumption and hence reduction on cost. However, the current study argued that such investment should be considered in terms of cost implication to the firm, because some technologies require huge financial investment. The study further argues that benefits from such initiatives create additional energy for supply and reduction of energy expenses. This can be simulated by the Kenyan manufacturers sector so as improve its competitive processes by weighing in the financial implication to the firm which may erode any effort in sustaining competitiveness. It is also important to note that the findings by Wilkinson and Kituyi (2006) revealed that ineffective technology leads to high production costs and thus high product price. As such, companies can reduce such costs by adopting efficient technologies in their production systems and processes especially in Kenya. However, this can be done by assessing cost implication before committing firm financial resources in any efficient technological process.

In such cases, the Kenya Association of Manufacturers (KAM) decision to establish Centre for Energy Efficiency and Conservation (CEEC), gains in energy management are yet to be achieved and manufacturing firms can continually enhance implementation of energy management practices. Previous studies also show that investment in energy management measures in fuel is significant since such a programme generates greater macroeconomic benefits – more jobs and greater growth (Lewis et al., 2013).

Studies by Friedmann et al. (2008) also reported that the use of low-energy technologies, reduction of wattage in electricity bulbs and lamps such as LED were some of the energy management practices that manufacturing firms can institute. Energy management

practices, as noted by NEED (2012) include the use of technology that requires less energy to perform the same function. Energy management practices can also be attained through policy guidelines, and training of users on efficient technology usage.

CONCLUSION

The study objective was to examine the effect of implementation of energy efficient technology on sustaining competitive advantage among manufacturing firms. The regression results from Table 2 revealed that there was a statistically significant effect of implementing energy efficient technology on competitive advantage among manufacturing firms p-value = 0.05. The findings disagreed with the findings of Friedmann et al. (2008) who reported that the use of low-energy technologies, reduction of wattage in electricity bulbs and lamps such as LED were some of the energy management practices that manufacturing firms can institute to reduce energy costs. Energy management practices as noted by NEED (2012), include the use of technology that requires less energy to perform the same function and if manufacturing companies are to implement such technologies, and then the resultant benefits can significantly improve competitive advantage for their firms. However, in Table 2, correlation test revealed that the practice of energy efficient technology does not contribute to competitive advantage at p = 0.05 where the coefficients were negative. As such, it disagreed with Friedmann et al. (2008) finding which noted that there are great advantages that can be derived from implementing an energy efficient technological firm. It should therefore be concluded that energy efficient technology can be adopted but employee apathy and negligence can render the technology inefficient while cost becomes an impediment in sustaining competitive advantage.

As such, if the Kenyan firms can strive to invest in efficient technologies, then the resultant benefits are significant in reducing energy expenses, production costs and enhance differentiation strategies. However, energy management in industries can be increased through customized information technology solutions but cautiously. As such, related innovative information technology software can be applied by industrial related firms so as to monitor its consumptions and usage. In addition, the use of renewable energy such as solar is expected to also increase exponentially by the year 2020 and Kenyan manufacturing firms should tap into this opportunity.

The use of low-consumption combustion engines and energy saving technologies are also expected to be in use globally and that fuel consumption vehicles are expected to fall by 17% by the year 2010, yet Kenyan manufactures are yet to invest in the new breed of vehicles and equipment's (Hartmann and Huhn, 2009) and (Victoria, 2007). It should also be noted that Backlund et al. (2012) states that a gradual practice of energy management leads to a reduction

of operating costs and increases competitiveness and productivity of the company and this is so in the Kenya's situation.

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