

Techno-Structural Interventions and Organizational Performance of Geothermal Development Company, Kenya

Jared Matonda Aiko

Student, School of Business and Entrepreneurship
Jomo Kenyatta University of Agriculture and Technology, Kenya

Dr. Daniel Wanyoike

Senior Lecturer, School of Business and Entrepreneurship
Jomo Kenyatta University of Agriculture and Technology, Kenya

Abstract: *Techno-structural intervention addresses the structural and technological issues in the organization. They particularly help in the identification of critical business drivers that provides the best results thus plays a critical role in promoting organizational performance. However, Geothermal Development Company's techno-structural interventions have not sufficiently supported their key strategic goals and the company is yet to achieve adequate organizational performance. It is against this background that the researcher examined the effect of techno-structural interventions on organizational performance of Geothermal Development Company. The study was guided by socio-technical systems theory. The target population was the 39 managers and chief of section officers at Geothermal Development Company. Census design was employed. Questionnaires enables the researcher to obtain large amounts of information from the respondents thus were used in the study. The study also applied descriptive and inferential statistical data analysis methods. Descriptive data analysis included percentages, means and standard deviations. Inferential data analysis employed correlation analysis and linear regression analysis to establish the relationship between techno-structural interventions and organizational performance. Descriptive findings established that techno-structural interventions affected organizational performance of Geothermal Development Company. Correlation analysis results indicated that the correlation coefficient value was ($r= 0.739^*$, $p=0.000$). The results implies that the techno-structural interventions affected organizational performance. In regression analysis, the coefficient of determination was $R^2= 0.545$ implying that techno-structural interventions explained 54.5% of variation in organizational performance. The study concluded that techno-structural interventions enhance technology use with the purpose of improving organizational processes, effectiveness and performance. The researcher recommends that Geothermal Development Company should intensify the use of technology in their organizational processes. This should be done by focusing the techno-structural interventions towards work redesigns for the purposes of improving operational efficiency. The study will be of great importance to Geothermal Development Company and energy sector at large in Kenya. It provides useful information that will enable them improve on technology use, efficiency, production capacity, cost reduction and adoption to change in terms of operations and service delivery. It will also be helpful in the formulation and implementation of energy policies that can encourage investment in the energy sector and improve performance.*

Keywords: *Techno-structural Interventions, Organizational Performance, Geothermal Development Company*

1. Introduction

Energy sector is an important driver of industrial growth through provision of fuel and power to other sectors of the economy hence its performance is an area of major interest (Raitzer, Blöndal, & Sibal, 2019). Companies within the energy sector operate in a dynamic environment where a change in organizational designs and the involvement of employees in such changes are of paramount importance. According to Azzuhri (2018) strategic interventions play a significant role in shifting energy consumption behavior to be more efficient, productive, and reliable. Techno-structural interventions, in particular, handles the structural and technological issues in the organization (Singh & Ramdeo, 2020). They incorporate social-technical systems which are employed in the adoption of customized change models. These models are flexible and integrative to the social networks of the organization hence enable it to adopt change and improve performance.

Energy sector corporations in Kenya are mandated to improve the viability of the energy sector and create a more sustainable business model for the concerned companies (Mutangili, 2021). However, the government's efforts toward achieving cost-reflective tariffs among energy companies are yet to achieve the desired results. As such, they have not

been able to lessen the energy sector's reliance on subsidies (Muriuki, Guyo, Odhiambo, & Kinoti, 2019). These corporations remain in the difficult position of the utilities which implies inadequate performance as well as a discouragement to investment into the sector. Geothermal Development Company (GDC) develops steam fields and sell geothermal steam for electricity generation to Kenya Electricity Generating Company PLC (KenGen) and other power producers in Kenya. The company also engages in geothermal resource assessment, exploration, appraisal and production drilling, geothermal reservoir management and sale of steam.

Geothermal Development Company has growth strategy aimed at developing 1065 megawatts by the year 2030 but the company lacks effective techno-structural interventions to support their key strategic goals. The company accounts for approximately 863 megawatts despite having a potential of between 7,000 and 10,000 MW. Moreover, the cost of energy has been a significant hindrance to energy demand and overall performance of energy sector. As such, Kenya continues to lose out on foreign direct investments partly due to this problem, with considerable loss of economic opportunities. The past research works have not addressed the link between strategic interventions and organizational performance of Geothermal Development Company. Moinkett (2015) examined the organizational structure and strategy implementation at Geothermal Development Company in Kenya. Similarly, Kariuki (2017) examined strategic alliances and strategy implementation at Geothermal Development Company. Findings revealed that managerial control and structural challenges negatively impacted on strategy implementation and performance of Geothermal Development Company. The current study examined the effect of techno-structural interventions on organizational performance of Geothermal Development Company.

2. Objective of the Study

The objective of the study was to determine the effect of techno-structural interventions on organizational performance of Geothermal Development Company.

3. Literature Review

Techno-structural interventions play a vital role in developing work designs and structures of a company which provide strategic support to organizational effectiveness, efficiency and development (Singh & Ramdeo, 2020). They are usually flexible design oriented and involve technological changes that promotes adaptability which needed for alignment to environmental changes (Azzuhri, 2018). Energy sector companies particularly in the public sector need to understand the parameters that determine the readiness for change so as to motivate and prepare the employees for change. Urban and Heydenrych (2015) asserted that the main purpose of techno-structural interventions in the energy sector companies to promote management effectiveness, production efficiency and increase in revenue generation. They majorly comprise the innovation interventions, socio-technical systems, knowledge management and structural redesigning.

Development of the energy sector companies such Geothermal Development Company depend on the innovations in the utilization of the technology (Mangi, 2018). Innovation strategies help in integrating geothermal energy systems with other organizational resources for the purposes of increasing the production capacity. However, lack of appropriate innovation interventions is attributable to inefficiency in energy production which generally implies higher operating costs to the company (Kartalidis, Atsonios, & Nikolopoulos, 2021). Therefore, effective innovation interventions are critical energy generation efficiency as they lead to reduction of operating costs and increase performance levels. Furthermore, production/generation efficiency increases the availability of energy resources for utilization hence an increase in energy-dependent activities which contribute to economic wellness at large (Lin & Zhou, 2022).

Socio-technical systems are important in integrating organizational performance goals and technology use into the company strategies (Rosenbloom, 2019). Energy sector companies including the Geothermal Development Company operate a highly dynamic environment and are affected by constant technological changes. Business environment changes calls for alterations of structures and processes for the company to survive and remain sustainable. Techno-structural interventions incorporates knowledge management aspect which involve plans for managing information and knowledge for the company (Gloet & Samson, 2020). In energy generation companies, Knowledge management strategies align company strategy and objectives pertaining to cost reduction, efficiency, and generation capacity. Furthermore, techno-structural interventions includes structural redesigning that entails organizational stability and strength of its structures. According to Soltani, Gharali, and Dusseault (2019) environmental changes may necessitate strategic change which imply alteration of company structures. Effective structural redesign ensures that structures remain stable despite the change and the company is able to achieve desired results.

Socio-technical systems theory was propounded by Emery and Trist in 1960. Socio-technical systems theory describes the strategic interventions in regard to integrating organizational processes and technological intervention into an effective system. Gottschamer and Zhang (2020) opined that organizations, particularly, the energy companies are highly affected by technological advancements thus require a well-designed change model that enhance compatibility of their structures and technology use. Socio-technical systems theory states that an organization is made up of interacting sub-systems. A well-functioning company has workforce with capabilities who follow the laid down processes, use technology, operate within a physical infrastructure, and work towards attaining organizational goals (Geels, 2019). Socio-technical systems theory brings about a systems perspective which is a robust and useful way of looking at the performance of energy sector companies (Sony & Naik, 2020). Therefore, socio-technical systems theory relates to the current study. The challenges and the exciting opportunities faced by Geothermal Development Company lie at the intersections between the employees' understanding of the company's operational system and techno-structural interventions. Therefore, socio-technical systems theory provides a useful tool to help Geothermal Development Company understand, analyze and improve the innovation interventions, socio-technical systems and structural redesigning to achieve efficiency and improved organizational performance. Conceptual framework on figure 1 shows the relationship between techno-structural interventions and organizational performance of Geothermal Development Company in Kenya.

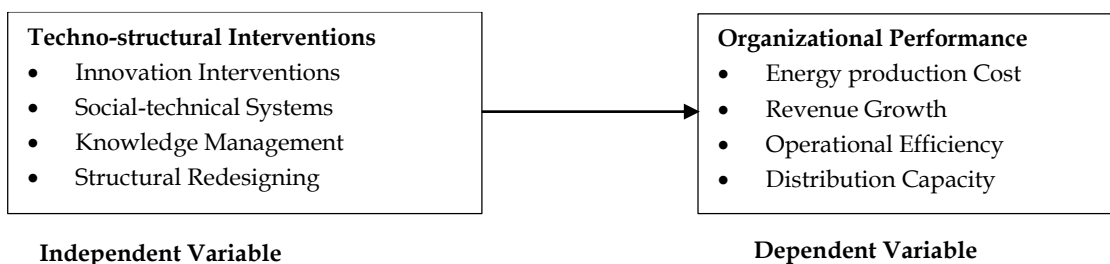


Figure 1: Conceptual Framework

Empirical Studies related to techno-structural interventions and organizational performance have been reviewed. Azzuhri (2018) examined techno-structural intervention and its effect on readiness for change in the Indonesian government-owned corporation. The findings indicated that readiness for change was affected by employee involvement. The results further revealed employee involvement had a significant effect of work design on readiness for change. However, the results revealed that restructuring organization has no effect on readiness for change. Moinkett (2015) examined the organizational structure and strategy implementation at Geothermal Development Company in Kenya. Results revealed that organization structure influence strategy implementation to a large extent. Based on the findings, GDC operates an organic organizational structure which is flexible enough to allow adjustments during strategy implementation. Al-Masaeid (2020) evaluated the organizational development interventions to solve performance management challenges. The study found that companies management don't focus on proper training to the employees thus were not able to focus on their work. They also found that sole emphasis on productivity of the organization in terms of sales was attributable to low performance level. The various loopholes and challenges to the organization's structure, system, style, and skills resulted into undesirable revenue levels. Kariuki (2017) examined strategic alliances and strategy implementation at Geothermal Development Company. Findings revealed that managerial control and structural challenges negatively impacted on strategy implementation and performance of Geothermal Development Company. Akeke (2019) researched on the strategic interventions and performance of small and medium enterprises in Nigeria. The results showed that organizational learning positively boosts performance of the SMEs in Nigeria. However, cultural values and leaning taken together does not influence organizational performance. The organizational learning boost performance through team learning, embedded system continuous learning. Therefore, an organizational strategic intervention through continuous learning is required for a company to improve its performance. Johnston and Uro (2021) suggested that energy companies require to be increasingly agile in reviewing their strategic priorities. They therefore need to transform their core business operations by optimizing their cost structure, redesigning the supply chain. This will increase the speed of capital and resource reallocation.

Research gaps were identified from the empirical review of the past studies. A study by Moinkett (2015) showed that organic organizational structure has flexibility that allow adjustments for effective strategy implementation. The current study builds on the study by Moinkett (2015) through incorporating techno-structural interventions to further explain the adjustments in strategy implementation and resultant effect on GDC's organizational performance. Akeke (2019) covered only two elements of strategic interventions including organizational leaning and cultural values which had insignificant effect when taken together. This study employed other strategic interventions comprising techno-structural interventions

and was carried out at Geothermal Development Company. The study by Azzuhri (2018) was based techno-structural intervention as the predictor variable. However, the findings indicated that readiness for change was affected by employee involvement. Employee involvement had a significant effect of work design on readiness for change. It is evident that the key parameters of techno-structural interventions were not analyzed. The present study discussed techno-structural interventions including innovation interventions, socio-technical systems, and structural redesigning and their effect of organizational performance of Geothermal Development Company.

4. Research Methodology

The current study applied descriptive research design. Descriptive research design aims to obtain information to systematically describe a phenomenon, situation, or population (Neelankavil, 2015). It was helpful in collection of detailed information about the effect of strategic interventions and organizational performance of Geothermal Development Company. The study targeted all the 39 managers and chief of section officers at key organizational divisions of Geothermal Development Company including strategy, research and innovation, corporate services, human resources and administration, geothermal resource development, drilling and infrastructure, and finance. Census technique was employed where all the 39 managers and chief of section officers were involved in the study. The current study used questionnaires in data collection. Questionnaires enables the researcher to obtain large amounts of information from the respondents thus suited the current study. The current study applied descriptive and inferential statistical data analysis methods. Descriptive data analysis incorporated percentages, means and standard deviations to describe the study variables. Inferential data analysis employed correlation analysis and linear regression analysis to establish the relationship between techno-structural interventions and organizational performance. Statistical Packages for Social Sciences (SPSS) aided the data analysis and the findings were presented through tables. Regression analysis was conducted using the following model:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Where;

Y = Organizational Performance

β_0 = Constant

β_1 = Beta Coefficient

X_1 = Techno-structural Interventions

ε = Error of Margin

5. Findings

This section outlines the descriptive and inferential findings of the study.

5.1 Descriptive Findings of the Study

The study aimed to determine the effect of techno-structural interventions on organizational performance of Geothermal Development Company. The findings are presented on Table 1.

Table 1: Effect of Techno-structural Interventions on Organizational Performance

Techno-structural Interventions	N	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev.
Techno-structural interventions improve our company's operational effectiveness and revenue generation.	31	41.9%	38.7%	9.5%	9.7%	-	4.13	0.957
Innovation Interventions influence the efficiency of our energy production processes.	31	45.2%	38.7%	12.9%	3.2%	-	4.26	0.815
Social technical systems allow our company to align to change brought about by intervention of technology.	31	35.5%	19.4%	25.8%	12.9%	6.5%	3.65	1.279
Techno-structural interventions enhance spread of knowledge which boosts our output.	31	32.3%	29%	32.2%	6.5%	-	3.87	0.957
Structural redesigning allows our company to work with technology in a manner that advances our organizational goals.	31	51.6%	22.6%	9.7%	16.1%	-	4.10	1.136

Research findings on Table 1 indicates that 41.9% of the respondents strongly agreed (Mean=4.13; Std.Dev.=0.957) that techno-structural interventions improve the operational efficiency and revenue generation of Geothermal Development Company. Adoption of techno-structural interventions enables the company to improve the work design and processes in an efficient manner and maximizes the effectiveness. 45.2% of the respondents strongly agreed while 38.7% also concurred thus 83.9% at least agreed (Mean=4.26; Std.Dev.=0.815) that innovation interventions influence the efficiency of energy production processes. Innovation intervention presents the company with structured opportunity make product changes to meet the needs of the consumer. Increase in uptake of energy products leads to rise in revenue levels thus better performance. However, majority 25.8% of the respondents had differing views (Mean=3.65; Std.Dev.= 1.279) on whether social technical systems allows the company to align to change brought about by intervention of technology. It was not clear how social and technical elements are optimized at Geothermal Development Company. Respondents were also indifferent (Mean=3.87; Std.Dev.=0.957) on effect of techno-structural interventions and spread of knowledge for the purposes of boosting the output. Majority (51.6%) of the GDC managers and section chief officers strongly agreed (Mean=4.10; Std.Dev.=1.136) that structural redesigning allows the company to work with technology in a manner that advances organizational goals. The findings relates to Kinampai (2019) who assessed the factors affecting supplier performance in Geothermal Development Company. He found that information communication's technology affect the performance. Adoption of information communication technology is an aspect of techno-structural interventions which were found to have an effect on organizational performance.

Table 2: Organizational Performance of Geothermal Development Company

Organizational Performance	N	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev.
Strategic interventions influence organizational Performance.	31	54.8%	16.1%	22.6%	6.5%	-	4.19	1.014
Our revenue levels have increased for the past 5 years.	31	35.5%	48.4%	12.9%	3.2%	-	4.13	0.885
We maintain optimal energy production costs.	31	45.2%	22.6%	22.6%	9.7%	-	4.03	1.048
Our energy production capacity has increased for the past five years.	31	29%	35.5%	29%	6.5%	-	3.87	1.922
Adequacy of energy distribution depend on effectiveness of strategic interventions.	31	35.5%	41.9%	12.9%	9.7%	-	4.03	0.948

Descriptive findings shows that 54.8% of the GDC managers and section chief officers strongly agreed (Mean= 4.19; Std. Dev.=1.014) that strategic interventions influence organizational performance. At least 83.9% of the respondents concurred (Mean= 4.13; Std. Dev.=0.885) that revenue levels of Geothermal Development Company have increased for the past 5 years. Increase in revenue level indicates increase in organizational performance in the same period. Furthermore, 29% of the GDC managers and section chief officers admitted (Mean= 3.87; Std. Dev.=1.922) that energy production capacity has increased for the past five years. Performance of GDC is determined the level of energy production and an increase in their production capacity implies improvement in performance for the past five years. Additionally, 45.2% of the respondents stated that GDC maintain optimal energy production costs which enhances performance. Finally, 35.5% of the GDC managers and section chief officers concurred (Mean=4.03; Std. Dev.= 0.948) that adequacy of energy distribution depend on effectiveness of strategic interventions. The findings shows that techno-structural interventions affect organizational performance of Geothermal Development Company. They improve operational efficiency and help managers to effectively adjust to the changes in the external environment. The findings relates to Akeke (2019) on the strategic interventions and performance of small and medium enterprises in Nigeria. His findings established that strategic interventions helps in optimizing cost structure, redesigning the supply chain and increasing the speed of capital and resource reallocation thereby promoting organizational performance.

5.2 Correlation Analysis

Correlation analysis was undertaken to establish the strength and direction of relationship between the techno-structural interventions and organizational performance. The findings are illustrated on Table 3.

Table 3: Correlation between Techno-structural Interventions and Organizational Performance

		Organizational Performance
	Pearson Correlation	.739**
Techno-structural Interventions	Sig. (2-tailed)	.000
	N	31

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

Correlation analysis findings in Table 3 shows that there is a positive and significant relationship between techno-structural interventions and organizational performance of Geothermal Development Company. The correlation coefficient ($r=0.739^{**}$; $p=0.000$) is significant at 99% confidence level. This implies that techno-structural interventions enhance energy production capacity, revenue, and operational efficiency of Geothermal Development Company. Therefore, the adoption of innovation interventions, social-technical systems, knowledge management and structural redesigning contribute to improved organizational performance.

5.3 Regression Analysis

Regression analysis was conducted to predict the variations in organizational performance from the changes in the techno-structural interventions. Results are presented on Tables 4, 5 and 6.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.739 ^a	.545	.530	.41203

a. Predictors: (Constant), Techno-structural Interventions

The model summary indicates a strong relationship between techno-structural interventions and organizational performance. The correlation coefficient was R=0.739 with coefficient of determination R²= 0.545. It implies that 54.5% of variation in organizational performance is accounted for by variations in techno-structural interventions. As such, techno-structural interventions significantly affects the organizational performance of Geothermal Development Company.

Table 5: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.908	1	5.908	34.801	.000 ^b
	Residual	4.923	29	.170		
	Total	10.832	30			

a. Dependent Variable: Organizational Performance

b. Predictors: (Constant), Techno-structural Interventions

The Analysis of Variance (ANOVA) test the model fitness and overall significance. The F-value was 34.801 and significant at 95% confidence level. It implied that all the parameters of techno-structural interventions influenced organizational performance.

Table 6: Regression Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.895	.372		5.098	.000
Techno-structural Interventions	.537	.091	.739	5.899	.000

a. Dependent Variable: Organizational Performance

The study applied this linear regression model;

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Where;

Y= Organizational Performance

β_0 = Constant

β_1 = Beta Coefficient

X_1 = Techno-structural Interventions

ε = Error of Margin

The regression model is interpreted as; $Y = 1.895 + 0.537X_1 + 0.372$. The regression results shows that one unit change in techno-structural interventions leads to 0.537 unit change in organizational performance of Geothermal Development Company. This means that organizational performance depend on the techno-structural interventions.

6. Conclusion

The study concluded that techno-structural interventions focuses on enhancing technology use with the purpose of improving organizational processes, effectiveness and performance. Findings showed that techno-structural interventions are critical in promoting operational efficiency of Geothermal Development Company. Dynamics in the environment in which Geothermal Development Company operates positions change as an important element in their development process and long-term performance. The pace of change is mainly due to the increasing technology advancements and general change in customer needs. This necessitates proper handling of the situation through adoption of effective techno-structural interventions. Findings indicted that innovation interventions and social-technical interventions determine the achievement of the ultimate goal of organizational efficiency and effectiveness. Readiness of Geothermal Development Company in facing changes ought to be considered in application process of the techno-structural interventions. Findings established that knowledge management and structural redesigning as techno-structural interventions are associated with performance outcomes of Geothermal Development Company.

7. Recommendation

The researcher recommends that Geothermal Development Company should intensify the use of technology in their organizational processes. This should be done by focusing the techno-structural interventions towards work redesigns for the purposes of improving operational efficiency and organizational performance.

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