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Analysis of the technical efficiency of wayleave acquisition process :
A case study of transmission Infrastructure in Kenya

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ABSTRACT

Context and background

In response to national development challenges, the Government of Kenya has disseminated its development agenda through the 'Kenya Vision 2030, which aims at creating "a globally competitive and prosperous country with a high quality of life by 2030". Infrastructure projects are key enablers in spurring the socioeconomic development. Advocacy on the environmental, social sustainability, compensation, and restoration of wayleave acquisition for infrastructure development has been on the rise with various stakeholders involved with diverse requirements Wayleave acquisition in Kenya has been a major bottleneck to the implementation of infrastructure projects. Political interferences and activism have exacerbated the difficulties in wayleave acquisition process / right of way for the said infrastructure projects.

Goal and Objectives:

The study analyses the technical efficiency of the wayleave acquisition process on sampled transmission lines with various voltages and wayleave corridors sizes. This analysis will be instrumental to maximize output and on timely delivery of infrastructure projects in terms of the iron triangle parameters (scope, cost, and time) as the country seeks to transform into a middle-income country. the research analyses the efficiency of the wayleave acquisition process and the challenges faced in implementation of the resettlement action plans for transmission line projects in Kenya

Methodology:

The research employs Non-Parametric Data Envelopment Analysis (DEA) to assess technical efficiency of wayleave acquisition process. The research sought to maximize outputs in terms of time to realize the project (on time delivery rate) and minimize delays resulting from disruptions on right of way/ wayleave acquisition as the inputs. It further examines the input and output orientations efficiency to provide recommendation on process and policy changes.

Results:

The research findings show that a model is significant, and variables explains the technical efficiency of the wayleave acquisition process with an efficiency score (Theta of 1) otherwise other Decision-Making Unit (DMUs) are inefficient, depicting decreasing return to scale. Further policy interventions and recommendations have been provided to streamline the wayleave acquisition process especially under involuntary resettlement

Keywords

Wayleave acquisition, Resettlement, land tenure, infrastructure

1. INTRODUCTION

According to (Rolf Färe, 1983), Technical efficiency is the effectiveness with which a given set of inputs is used to produce an output given as set of constraints in an optimal way. Wayleave acquisition process is said to be technically efficient if infrastructure development output in terms of construction is achieved with optimal cost and no time overruns arising from stoppage claims, grievances/ disputes, and compliance with policy/legal framework.

According to the Land Act 2012, Part X section 143(2a) "wayleave is a right of way created for the benefit of the national government or county government, a local authority, a public authority or any corporate body to enable all such institutions, organizations, authorities and bodies to carry out their functions". The Land Act 2012, section 146, and the Land Act Regulations 2017 Part VII, provide for the procedures for the creation of wayleaves through the cabinet secretaries under whose purview the matter requiring a right of way falls or directly by the NLC on request from any government agency. Once acquired, wayleaves place restrictions on the use of privately owned land, they authorize the public organizations, authorities or agencies and their contractors or agents to access the land on which there is such a right of way for the purposes of building and carrying out maintenance of installations be it electricity transmission lines, oil pipelines or sewer lines among others. (Institution of Surveyors of Kenya, 2016) According to the Land Act section 148(1), compensation for acquisition of wayleave is paid for the loss of use of land and for any damage occasioned on the developments on the subject land parcel be they buildings, crops or trees as determined by a qualified valuer.

In KETRACO, the process of acquisition of wayleave and payment of compensation for affected assets can be summarized in the following steps: -

1. Resettlement Action Plan (RAP) study is undertaken
2. Implementation of the RAP starts with the validation of the valuation report and compensation of affected structures. Compensation for affected structures is done in two instalments – an initial amount of 70% and the balance of 30% paid upon confirmation of demolition and relocation of the affected buildings or structures.
3. Computation of affected acreages and preparation of schedules detailing land registration number, ownership details, total area of land parcel, affected area and impact of the wayleave on each land parcel.
4. Valuation of the land done is by external valuers/consultants along the transmission line to establish the market values to be used in the computation of compensation payable on each land title.
5. Approval of compensation schedule, preparation, and issuance of letters of offer for compensation for limited loss of use on land affected by a transmission line to the affected landowners.
6. Collection of acceptance of offers from the project affected people with the requisite documentation, execution of easements and registration of easements, and payment of compensation

With respect to compulsory land acquisition, all interests in the affected land transfer from the original private ownership and vest in the acquiring authority or government agency. In cases where the government is satisfied that land is required for a public purpose or in the public interest as defined in Article 40(3) of the Constitution of Kenya, a request is made to the National Land Commission (NLC) to acquire the land by the respective Cabinet Secretary or County Executive Committee member. The power of the government to expropriate or compulsorily acquire privately owned land and community land for public purposes is what is referred to as the power of eminent domain. The provisions and procedures for compulsory acquisition are provided for in Part VIII of the Land Act 2012, from section 107 to section 132 and part V of the Land Act Regulations 2017. The NLC is charged with the authority of certifying, that the subject land is required for public purposes or is in the public interest. In wayleave acquisition, restrictions are placed on the affected land, in particular the uses to which such land can be put and allows access to the right of way created but ownership does not transfer from the original landowner.

In many parts of the world, compensation for projected affected people has predominantly been the payment of cash for all their affected assets. The basis of valuation of land is the prevailing market value of similar type of land. "Market Value is the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion", (International Valuation standards Council (IVSC), 2017)

Compulsory acquisition of land and any placement of restriction on privately owned land in Serbia and Montenegro is governed by the Law on Expropriation which was enacted on 5th January 1996. In these two countries which were formerly within the republic of Yugoslavia, when constructing overhead high voltage transmission lines, only tower sites are acquired outright and not the entire wayleave corridor. For the wayleave corridor, a permanent industrial easement is established and granted by the local municipal authority to secure access for the construction, subsequent operation, and maintenance of the transmission line. Compensation may or may not be paid where a permanent industrial easement has been established as provided for by the law on Basic Proprietary Relations enacted by the Parliament of the SFR Yugoslavia and still valid in both Serbia and Montenegro. Valuation for land at the in the tower sites which requires expropriation is carried out by the State Revenue Office not the power company or the landowners to prevent bias in the determination of values for compensation. (Electric power Company of Serbia, April 2005)

In Uganda, the Uganda Land Acquisition, Act Chapter 226 and the Uganda Land Act, Chapter 227 are among the substantive laws governing land acquisition for public purposes and compensation for the same. The laws in Uganda provide for compensation in cases where the land is fully taken over by the government and where restrictions are placed on private land, but ownership of the land has not transferred to the government.

The Land Act and the Acquisition Act, Chapter 189 of Zambia provides for both compulsory land acquisition for public purposes and the placement of restrictions upon privately owned land by the government for the benefit of the public and procedures for compensation for those affected. Further to the two laws above, Zambia has the Electricity Act, Chapter 433 gives most of the provisions applicable to acquisition of wayleave or access rights and compensation for land used for the

development of utilities like electricity transmission lines (Africa Biodiversity Collaborative Group Report, 2013).

The basis of valuation for structures or buildings for compensation for wayleave acquisition is gross replacement cost". According to the International Valuation Standards 2017 "replacement cost is that of a modern equivalent asset, which is one that provided similar function and equivalent utility to the asset being valued, but which is of a current design and constructed or made using current cost-effective materials and techniques". With respect to compensation of trees and crops many countries have legally defined rates. The compensation rates for crops and trees consider the loss of income during the period of re-establishment of the crop/trees. The reference nation in the study has context similarity in terms of level of development GDP per capita level, land tenure system and existing bilateral agreements to develop electricity interconnectors agreement for power trade framework within the sub- Saharan region.

In Kenya, the rates for compensation for trees are provided by the Kenya Forest Service for through a gazette notice and reviewed every two years. Gazettement of crop compensation rates has traditionally been done by the Ministry of Agriculture every two years but this has not happened in the past 8 years because the function of agriculture was devolved. There have been no standardized crop compensation rates to date due to the complexities of linkages between the 47 counties with the Ministry of Agriculture. (Kenya Law Reform Commission , 2010)

In countries where the legal framework and administration of crop compensation rates is not well structured, implementation of infrastructure projects which require wayleave gets complicated with greater likelihood of disputes and grievances from the PAPs leading to delays in project implementation and increased litigation against the project from communities in project areas. Payment of cash compensation to low-income project displaced people for their lost assets has been shown to result in long term impoverishment since such persons do not have the capacity to handle large quantities of money (Reddy, Smyth, & Steyn, 2015). There is a trend to increasingly emphasize the concept of livelihood restoration beyond just the payment of compensation for people affected by infrastructure development projects. Livelihoods can be defined as the full range of activities and means which people, households and communities utilize to make a living (Reddy, Smyth, & Steyn, 2015).

All the multilateral finance organizations including the World Bank and its affiliates require that project proponents improve or restore livelihoods, living standards and social welfare of PAPs. IFC PS5 Guidance Note 11 states that "compensation alone does not guarantee the restoration or improvement of the livelihoods and social welfare of displaced persons and communities". Restoration and improvement of livelihoods often includes many interconnected assets that may include access to productive land, marine and aquatic resources, access to social networks, access to natural resources such as timber and non -timber forest products, medicinal plants, hunting and gathering grounds, grazing and cropping areas, fresh water, as well as employment and capital" In project management it has become increasingly important to address the matter of livelihood restoration beyond just the payment of compensation in the form of cash.

Globally, there is increased pressure to plan and implement infrastructure projects such as transmission lines and associated facilities in a socially responsible manner. Most of Kenya's

development partners including the World Bank, International Finance Corporation (IFC) among others, have revised their Performance Standards/ Operational Policies with respect to environment, and social safeguards to ensure that the infrastructure development projects which they finance are implemented sustainably while upholding the rights of the project affected communities (IFC World Bank, 2012).

The wayleave acquisition process also faces numerous challenges which result in unprecedented delays to project completion time due to work stoppages, ultimately leading to budget overruns. Other challenges include unrealistically high expectations of compensation or resettlement to their satisfaction by affected communities, speculative and opportunistic behavior by PAPS after a transmission line route has been confirmed and undertaking land subdivisions after the cut-off date.

To achieve seamless implementation of infrastructure projects especially for utilities, there is need to analyze the technical efficiency of the wayleave acquisition process to inform policy recommendations. Acceptance and buy-in into a proposed infrastructure project are largely influenced by clarity of legal provisions for compensation of affected assets and resettlement of project affected people (Reddy, Smyth, & Steyn, 2015). Therefore, anchoring of the resettlement policy framework in the Land Act regulations will have significant effect on acceptance and efficiency of the wayleave acquisition process for electricity transmission infrastructure.

1.2 Statement of the problem

Wayleave is a right of way (ROW) utilized for infrastructure development on land therefore interfering with the full usage of the parcel of land. It plays a critical role in providing the physical platform for development of the infrastructure.

In Kenya, the legal framework for wayleave acquisition is anchored in the Land Act 2012, (Part X-Easements and Analogous rights) which describes the roles of different actors in the wayleave acquisition process (Goverment of Kenya, 2016) Resettlement of project affected people (PAPs) and Project displaced people (PDPs), is guided by the resettlement policy framework where affected assets are valued and compensated at current market value to pave way for the project.

However, implementation of wayleave acquisition process has faced numerous challenges including but not limited to land speculations, unreasonable compensation demands, socio-cultural issues which negatively impact resettlement, limited resource envelope for compensation and encroachment of the proposed or acquired wayleave trace. With the promulgation of new constitution in 2010, devolution created 47 counties, this resulted in accelerated urbanization in some regions. With increasing system requirements for more transmission line infrastructure and the resultant need for acquisition of right of way, there is competing uses for land, a finite resource.

In wayleave acquisition, the enumeration, assessment, and valuation of affected agricultural and biological assets faces a challenge as result of the creation of counties. Rates for compensation of crop enterprises were previously generated and reviewed by the Central Agricultural Board under the Ministry of Agriculture under the old constitution. However, since year 2013 when devolution came into existence, the Central Agricultural Board was dissolved leaving a gap in the role initially played by the board in the review and gazettement of crop compensation rates for agricultural and biological assets. Agriculture being a devolved function all the counties under the guidance and coordination of

the Joint Agricultural Sector Inter-Governmental Secretariat (JAS-IGS) are required to come up with harmonized crop compensation rates and have these rates gazette by the Ministry of Agriculture.

There is a gap in the legislative framework with respect to the methodology for computation of compensation for limited loss of use of land acquired for right of way of transmission line infrastructure where there is no outright acquisition of the entire affected land.

In other jurisdictions within the developing world, right of way acquisition for public purposes supersedes private interests, in those countries the acceptance of infrastructure development projects is perceived to be higher than in Kenya for example Ethiopia and Tanzania (World Bank, October 2016) The methodology to measure efficiency in the process varies with different determinants. Therefore, the study seeks to explore ways to improve performance and efficiency by addressing the gaps/challenges in the resettlement policy framework implementation through various methodologies including analyzing how the anchoring of such policies in legislation can benefit the development of infrastructure projects in Kenya. In ascertaining the level of efficiency in wayleave acquisition process, Parametric stochastic frontier approach (SFA) or non-parametric data envelopment analysis (DEA)will be utilized. The methodology deploys a benchmarking tool that evaluates a population of DMUs/PMUs (transmission infrastructure wayleave acquisition in our case) in their performance in converting input to outputs. The purpose of the analysis is to identify the wayleave corridor that most effectively transform their inputs to outputs in terms of acquisition process. These units are located on the effectiveness frontier.

1.3 The Research objectives.

The overall objective of the study is to analyze the technical efficiency of wayleave acquisition process for the transmission lines in Kenya. The specific objectives of the study will be:

i. To establish efficiency level of the wayleave acquisition process that contributes to construction progress of transmission line.
ii. To explore the relationship between the human settlement's areas of acquisition with progress of infrastructure development in terms of time and cost efficiency

1.4 Rationale / Justification

Timely completion of project will largely depend on availability right of way without any constraint. With increasing demand and growth in networked utility infrastructure development which utilizes land partially during construction, compulsory acquisition is deemed expensive, overall making the project costly. The research study examines the efficiency in acquisition of wayleave corridor and how it influences the performance in terms of construction. The research would yield some interesting insights which may interest regulators, policy makers, development partners, utility infrastructure development and Government agencies.

2. LITERATURE REVIEW

2.1 Theory of Constraints

The assumptions of the Theory of constraints were first advanced by Eliyahu M. Goldratt in his book "The Goal" published in 1984 and later in "Critical Chain in 1997". The main thrust of the theory of

constraints is that a project or a system can be improved by focusing or concentrating on the most important issues (Masila & Gachunga, 2016). In the theory of constraints, the most important constraint which is preventing the achievement of set targets is identified and systematically eliminated in a step-by-step process. This applies to project management in the sense that a project is a system of various activities which need to be managed and optimized to achieve efficiency and effectiveness within the allocated budgets and project implementation period. Our study aims at establishing what factors influence the efficiency of wayleave acquisition with respect to the development of electricity transmission line infrastructure in Kenya today. Constraints can be physical, or policy related, physical constraints are easy to identify and remove, whereas constraints which are due to policy matters are more difficult to identify and eliminate. Eliminating policy related constraints has a bigger impact on the system improvement then the removal of physical constraints.

2.2 Stakeholder Theory

This is a theory of organizational management and its impact on achievement of organizational goals. A stakeholder is an individual or group which will be impacted by activities or outcomes of a project such impacts can be negative or positive. A company using the stakeholder approach will have better performance in terms of increased efficiency and effectiveness in operations and achievement of organizational goals (Masila & Gachunga, 2016) Stakeholder interests can be very varied or even be diametrically opposed, balancing the interests of the various stakeholders without compromising the efficiency of its operations and simultaneously achieving organizational goals within the required timeframe is an important function in project management. Negotiations and dialogue are the main ways of resolving conflicts in stakeholder interests and arriving at solutions which do not compromise the achievement of set organizational goals, (Masila & Gachunga, 2016). In the case of wayleave acquisition for transmission lines in Kenya community engagement is vital. As part of best practices, community engagement should be integrated into the core business in the development of infrastructure projects. When this is done, cost and time overruns during project implementation are likely to be reduced and it mitigates against disputes and grievances (Power Africa, 2018)

3. EMPIRICAL LITERATURE REVIEW

In other parts of the world similar studies have been done, a study entitled “Issues and Challenges in electricity sector in India” identified land access together with obtaining the required environmental licenses and other clearances on time as one of the significant factors to the timely completion of power infrastructure projects on time and within budget, (Dubey, 2015). This aimed at understanding the various challenges and risks faced in the power sector in India and proposing possible remedies to these problems. The researcher relied mainly on secondary data drawn from reports from the Ministry of Power, the Finance Commission of India, and the Government of India. This study recommended that the electricity company utilizes comprehensive an improved project management procedures and structures to mitigate against challenges in the power sector and enable the delivery of power projects within the required timeframes. According to (Robert Kibugi, 2016), compulsory land acquisition has been anchored in the constitution, the Land Act of 2012.The methodology of valuation and computation of the compensation for acquired land and other assets have been provided under Land Act regulations of 2017 and the roles of each of the actors with respect to the land acquisition, compensation to the PAPS, and the taking of possession of the

acquired land is provided for in the Land Act, 2012 and the Land Act Regulations of 2017 (Goverment of Kenya, 2009).

Whereas several studies have been done in land access for large scale electricity infrastructure projects in Kenya, few have been done specifically about wayleave access for high voltage transmission lines. Masila (2016) studied the factors affecting the implementation of electricity expansion projects in Kenya and focused on the Kenya Power and Lighting Company Limited (KPLC). The study relied on primary data drawn from a sample of 33 respondents consisting of 3 projects managers and 30 project implementation team members from a target population of 66 respondents. The study examined the influence of support from top management, procurement procedures, community engagement and availability of financial resources on the effective implementation of electricity infrastructure projects by the Kenya Power and Lighting Company. The findings of the of this study were that inadequate financial resources, lack of top management support, inadequate community engagement and procurement procedures affect the effective implementation of electricity expansion projects in Kenya.

In another study done by Kariungi (2014), the researcher looked at the determinants of timely completion of projects carried out by KPLC in Thika, Kenya. The main objective of the study was to identify and examine factors which affect project implementation right from the project planning stage through the construction period to project commissioning. The study looked at project planning tools, availability of funds, procurement procedures, stakeholder analysis, managerial skills, and climate factors. The study relied on primary data from a survey of 100 respondents comprising project managers and members of the project implementation unit from KPLC, project contractors and consultants. According to this study, procurement procedures, climate factors (specifically rainfall), timely availability of funds, and adequate project planning greatly influenced the timely completion of projects by the KPLC. This study recommended that the top management of KPLC should motivate and provide the necessary support to all staff involved in project implementation, have continuous stakeholder engagement, utilize a participatory approach to engender community support and carry out comprehensive due diligence during procurement for project works and services. (Kariungi, 2014)

In a similar study focusing on four projects undertaken by the Kenya Electricity Generating Company (Kengen), Kagiri and Wainaina (2017) carried out research on the time and cost overruns in power projects in Kenya. The objectives of this study were to identify factors which contributed to time and cost overruns in government power projects, to establish the relative importance of said factors and to quantify the time and cost resultant from each of these factors. The study relied on primary data from 54 respondents who were drawn from project consultants/specialists, KENGEN staff (managers and engineers) and senior personnel from the project contractors. The study also utilized secondary data retrieved from contractual documentation, contractors' claims, monthly, quarterly, annual project progress reports and project completion reports (Kagiri & Wainaina, 2013).

The study focusing the KENGEN project identified the following as the main factors contributing to the time and cost overruns in public power projects. Delayed payments to contractors, cash flow challenges, delays in the procurement of materials and equipment, bureaucratic government procedures for requisite approvals, inadequate planning for the pre-construction activities by

KENGEN, late design changes, delays in approval and submission of drawings, variations in scope of works and challenges in handing over project sites to the contractor. The study recommended better contract management with penalties and incentives to be designed at the planning stage, better planning before project implementation including the undertaking of comprehensive risk assessment and management to identify possible challenges which may hamper effective project implementation, (Kagiri & Wainaina, 2013)

4. LITERATURE SUMMARY

The studies reviewed above have focused mostly on the outright acquisition of land for the development of electricity infrastructure, we have so far not been able to review a study which focuses specifically on the acquisition of right of way for the development of high voltage transmission lines in which limited land access rights for the project transfer to the implementing agency. This study focuses on factors which may influence the efficiency and effectiveness of the process of wayleave acquisition for the high voltage transmission lines being constructed in Kenya by KETRACO.

There is a gap in the Kenyan legislative framework with respect to the methodology for computation of compensation for limited loss of use of land acquired for right of way of transmission line infrastructure where there is no outright acquisition of the entire affected land. Acceptance and buy-in into a proposed infrastructure project are largely influenced by the clarity of legal provisions for compensation for affected assets and resettlement of project affected people, (Reddy et al, 2015). Anchoring the KETRACO resettlement policy framework in the Land Act Regulations is likely to have a significant effect on the acceptance of compensation for limited loss of use of land and ultimately on the efficiency of the wayleave acquisition process.

5. METHODOLOGY

In this section, the research methodology employed to address the research question will be discussed. It will detail the road map used to achieve the study objective.

5.1 Research design

Researchers used either parametric stochastic frontier approach (SFA) or non-parametric data envelopment analysis (DEA) which can be deployed to assess efficiency of wayleave acquisition process. DEA and SFA differ both in structure and implementation providing significantly different efficiency scores. Non-parametric DEA method calculates the efficiency of multiple decision-making units (DMUs) with a structure both input and output. Quantitative and qualitative data attributes will be used. Most past studies, they use the variable returns to scale (VRS) to measure (also known as BCC model which is named after Banker, Charnes, and Cooper (1984)) is recommended for evaluating efficiency (E. A. Ramalho, 2010) since the performance of wayleave acquisition process is not always linear.

In a nutshell, the BCC input-oriented model is well-suited for this research considering that the method does not need to explicitly specify a mathematical or functional form. It uncovers relationships among the DMUs which are the different transmission line (sh. Nasen and H. Kiaei, 2017) . The research sought to maximize outputs within time for delivery a project and minimize

delays occasioned stoppages and disgruntled PAPs during acquisition of wayleave as the inputs. It will further examine efficiency scores and provide recommendation on process and policy changes. In addition, the efficiency of the implementation of a transmission line project within budget and within the planned time frame is a general indicator of how efficiently the wayleave acquisition process was undertaken holding other factors constant (S. A. Rakhshan, 2017).

5.2 Data and Data collection tools

The research scope examined efficiency of wayleave acquisition process for the completed and energized transmission lines from the year 2010 to 2018 as the country embarked on electrification expansion of National grid strategies (MOE Reports) to achieve SDG 7. Secondary data will be collected through a desktop review of historical literatures, reports, and data on observed documented data with regards to resettlement and acquisition.

Data will be collected on the wayleave acquisition as an input variables and delivery time of transmission line as an output variable. The cross-sectional data was mined with key data elements entails on time delivery rate per project, acreage of trace to be acquired, the length and voltages of transmission line constructed, number of parcels affected, number of registered easements and derived acceptance of the project within the community where the infrastructure. The key output variable will be the project lifecycle time duration and respective project cost.

Besides, the data will capture and explore the significant relationship between the human settlement areas of acquisition with progress of infrastructure development. Thus, this study aims at providing meaningful insights into wayleave acquisition process technical efficiency and attainment of seamless construction progress of transmission line by averting the challenges experienced during implementation across the projects and providing recommendations.

5.3 Data analysis

The Data Envelopment Analysis (DEA) was originally developed by Charnes, Cooper, and Rhodes (CCR) (1978) to measure the technical efficiencies of firm at decision making units (DMU). Efficiency is defined as a ratio of weighted sum of outputs to a weighted sum of inputs, where the weights' structure is calculated by means of mathematical optimization linear programming and constant returns to scale (CRS) are assumed. The BCC and CCR input frontier model will be employed in the analysis of the "wayleave acquisition process in assumption that utility infrastructure requires acquisition of land as an input affected by other factors.

To achieve efficiency in transmission line construction with maximum output level, non-constrained right of way and other factors are key determinants.

In evaluating the efficiency, transmission line projects with various voltages and lengths are treated as DMU unit. Considering the study objective, attaining efficiency delivery time for project will be minimized however subject to constraints as expressed in the model below.

$$\min \quad e^t Z_0 e$$

$$\text{s.t} \quad \sum_{r=1}^{s} u_{r0} y_{r0} = 1,$$

$$\sum_{i=1}^{m} v_{i0} x_{i0} - v_0 = E^*_{00},$$

$$u_0^t Y - v_0^t X + v_0 \le 0,$$

$$u_{i0} y_{i0} - u_{j0} y_{j0} \le Z_{ij}, \quad \forall i, j \ \ (I)$$

$$-u_{i0} y_{i0} + u_{j0} y_{j0} \le Z_{ij}, \quad \forall i, j \ \ (II)$$

$$u_0 \ge 0, \quad v_0 \ge 0, \quad v_0 \text{ free.}$$

we add constraints I and II for selecting symmetric weights in the model by minimizing the sum of difference in symmetry between output dimension and dimension for in objective function. At optimal solution, unit DMU_q is BCC efficient when efficiency score equal one then it is called BCC efficient and otherwise it is called BCC inefficient. In addition, the BCC model decomposed the results and technical efficiency to constant return to scale, variable return to scale, NIRS_TE, and scale efficiency. (Aryavash., 2017)

The advantage of the DEA model is that it advises how the unit evaluated should mend its behavior through the output and input slack to reach efficiency hold output constant in terms of contracted time period to undertake the project while varying the factors affecting the rate of land or wayleave acquisition.

6. RESULTS/RESEARCH FINDINGS AND DISCUSSIONS

6.1 Research findings

Descriptive statistics related to wayleave acquisition process variable are presented in appendix 1: The study analyzed 26 DMUs (Sampled transmission line) of different voltage 16No (132kV), 4No (200kV), 5No (400kV) and 1No (500kV). However, it imports to note that 9No (132kV), 4No.(200kV) and 3No. (400kV) construction completed and project energized with high dispersion of delivery time. Table 1: shows study variable model summarized which includes the project cost, length in km, number of parcels, size of the wayleave trace and number of registered easements used for research with a p-value (0.008) which is statistically significant at 5% level in evaluation of the efficiency level with a Z score of 2.660.

Number of obs = 26 / Replications = 1,000
command: summarize on time delivery rate Project Cost USD Million No of Parcels per project No of Registered Easement Acceptance Quotient Total acreages affected (Ha), detail_bs_1:r(p50).

	Observed	Bootstrap		Normal based	
	Coef.	Std. Err.	z	P>z	[95%Conf. Interval]
_bs_1	245.545	92.263	2.660	*0.008	64.714 426.376

Notes: * significance level at 5%

Table 1: Bootstrap Result with 1000 Replication

From the result in fig 1 below, wayleave acquisition input-oriented DEA efficiency is calculated for individual DMUs. Indicating that {DMU1, DMU 7, DMU8, DMU11, DMU14, DMU16, DMU21, DMU22, and DMU26} operate efficiently with a theta value of 1 and ranking of 1. The rest of the decision-making units are inefficient with a value of less than 1:

```
      log type:  text
    opened on:   3 Jun 2020, 10:03:25

options: RTS(VRS) ORT(IN) STAGE(1)
VRS-INPUT Oriented DEA Efficiency Results:
```

	rank	theta
dmu:1	1	1
dmu:2	26	.195921
dmu:3	24	.233174
dmu:4	23	.259504
dmu:5	25	.212246
dmu:6	20	.441897
dmu:7	1	1
dmu:8	1	1
dmu:9	14	.675142
dmu:10	11	.850119
dmu:11	1	1
dmu:12	21	.412508
dmu:13	12	.823825
dmu:14	1	1
dmu:15	16	.612484
dmu:16	1	1
dmu:17	13	.756312
dmu:18	19	.521103
dmu:19	17	.54141
dmu:20	10	.954188
dmu:21	1	1
dmu:22	1	1
dmu:23	15	.664488
dmu:24	18	.523589
dmu:25	22	.30237
dmu:26	1	1

Fig 1: VRS – Input oriented DEA efficiency Results

6.2 Discussion of results

In summary, our approach decomposes the technical efficiency under BCC frontier model to constant return to scale, variable return to scale and scale efficiency level there after showing whether it exhibits increasing, decreasing and constant returns to scale. Most DMUs exhibit decreasing return to scale and since this is minimization duality problem then, our study objective means increase in parcels long a transmission line, increase in size of wayleave trace, results to inefficiency. This depicts a relationship between the human settlements' areas of acquisition with progress of infrastructure development in terms of time and cost efficiency.

VRS Frontier(-1:drs, 0:crs, 1:irs)

	CRS_TE	VRS_TE	NIRS_TE	SCALE	RTS
dmu:1	1.000000	1.000000	1.000000	1.000000	0.000000
dmu:2	0.146606	0.195921	1.000000	0.748291	1.000000
dmu:3	0.124712	0.233174	1.000000	0.534847	-1.000000
dmu:4	0.131006	0.259504	0.296352	0.504833	-1.000000
dmu:5	0.086355	0.212246	0.234200	0.406860	-1.000000
dmu:6	0.302678	0.441897	0.444647	0.684951	-1.000000
dmu:7	0.296356	1.000000	1.000000	0.296356	-1.000000
dmu:8	0.761755	1.000000	1.000000	0.761755	-1.000000
dmu:9	0.499861	0.675142	0.982233	0.740379	-1.000000
dmu:10	0.591785	0.850119	1.000000	0.696121	-1.000000
dmu:11	1.000000	1.000000	1.000000	1.000000	0.000000
dmu:12	0.180537	0.412508	1.000000	0.437657	-1.000000
dmu:13	0.285283	0.823825	1.000000	0.346290	-1.000000
dmu:14	0.751300	1.000000	1.000000	0.751300	-1.000000
dmu:15	0.290880	0.612484	1.000000	0.474919	-1.000000
dmu:16	1.000000	1.000000	1.000000	1.000000	0.000000
dmu:17	0.298559	0.756312	0.798967	0.394756	-1.000000
dmu:18	0.261418	0.521103	0.851193	0.501664	-1.000000
dmu:19	0.297002	0.541410	1.000000	0.548571	-1.000000
dmu:20	0.305643	0.954188	1.000000	0.320318	-1.000000
dmu:21	0.615343	1.000000	1.000000	0.615343	-1.000000
dmu:22	0.591048	1.000000	1.000000	0.591048	-1.000000
dmu:23	0.293424	0.664488	1.000000	0.441580	-1.000000
dmu:24	0.193810	0.523589	0.630863	0.370157	-1.000000
dmu:25	0.134706	0.302370	0.346240	0.445501	-1.000000
dmu:26	0.468184	1.000000	1.000000	0.468184	-1.000000

Fig 2: VRS frontier

From the analysis the efficiency is not affected by the voltage of the line as show cased in DMU1, DMU26 DMU16 However, it depends on the number of parcels on the wayleave corridor, the size of the corridor and compliance in terms of number of registered easements. In line with the study objective wayleave acquisition indeed affects the delivery of infrastructure projects. Hence providing us with a relatively fast method to determine which DMU alternative perform better across the various alternatives. Each DMU might experience unique challenges attributing the efficiency score. This information is useful to determine the policy interventions on wayleave process and address unique gaps from the inefficient DMUs especially with respect to dispute resolution and reduction of stoppages, RAP implementation and internal administrative process for compensation in order to improve the delivery time of a project.

7. SUMMARY, CONCLUSION AND RECOMMENDATIONS

The results of this study are of great interest to policy makers particularly on wayleave acquisition for infrastructure development. As the presence of the decreasing technical efficiency of the wayleave acquisition process, it informs the policy makes that appropriate measures should be taken to increase the technical efficiency in the wayleave acquisition. The wayleave acquisition process poses a unique challenge in Kenya's infrastructure development and public investment management as shown in VRS frontier. Infrastructure development comes with significant demand for land, which is not readily available. Inventories of the public land available for infrastructure investments are limited, making compulsory land acquisition an often-necessary step in infrastructure projects.

Causes of declining efficiency of delivery infrastructure can be attributed to weakness in the system of the process of wayleave acquisition, among other factors. From the efficiency score ranking some DMUs shows week performance i.e., low theta of up to 0.19 score. The performance and inefficacy may indicate gaps in legal framework on involuntary resettlement, insufficient social safeguards including livelihood restoration to increase acceptance of projects, reduce stoppages and improve turnaround time for project delivery.

8. CONCLUSIONS.

Inefficiency in wayleave acquisition also adversely affects large infrastructure projects expected to have high productivity gains for the nation. Implementation of infrastructure projects which is expected to translate into savings and economic growth is hindered during the land acquisition process, which is often fraught with compensation challenges. The challenges lead to inefficacies, disputes and delays in project implementation and significant cost overruns may be:

i. **First, identification of legitimate rights' holders can delay acquisition of land.** Gaps in the legal framework and administrative procedures have resulted in outdated and inaccurate land ownership information in Land Registries countrywide Further, occupants of the land in good faith must also be compensated and it is often difficult to establish the legitimate rights holders due for compensation especially if they do not hold formal rights to the land.

ii. **Second, determining and agreeing on 'just and prompt' compensation can be a source of dispute and delay in project implementation.** While there is agreement that 'market value' constitutes the basis for just compensation, disputes arise when compensation is not made promptly and in full. Disputes on the computation of compensation for limited loss of use of land affected by overhead high voltage lines is neither anchored in the Land Act 2012 nor the Land Act Regulations. These disputes in the acquisition of the wayleave for the power transmission lines will often lead to delays in the completion of transmission lines yet the high cost of power and regular power outages remain an ever-present constraint to doing business in Kenya.

iii. **Third, resettlement and restoration of livelihoods is not standardized as mentioned in different RAP reports.** This is mainly due to gaps in the legal framework particularly with regard to the aspect of livelihood restoration for which there is no express provision in either substantive law or the procedures in the regulations on wayleave acquisition in Kenya. The research has also shown different efficiency scores with different projects overlapping due to differences in approaches and methodology. Notably, differences indicate that while some projects recognize the need for some form of livelihood restoration, others do not, this can be attributed to the conditions given by the financiers.

iv. **Finally, the use of courts in resolving grievances related to wayleave acquisition also creates more delays.** Project implementation is delayed and budgetary allocation is exhausted because dispute resolution in court takes time.

9. RECOMMENDATIONS.

Mitigating the inefficiencies related to wayleave acquisition in different decision-making units that is the infrastructure projects may require legislative and administrative reform.

i. This includes protection of the wayleave corridor or land currently available and strengthening the legislation which governs wayleave acquisition, payment of compensation for the affected land and developments thereon and the resettlement of project affected persons.

ii. The research paper further recommends that the provision of payment assurance (such as via an escrow account) for financing land acquisition and resettlement to ensure immediate availability of funds for compensation when needed.
iii. There is need to evaluate the legal framework for wayleave acquisition and compensation for affected assets against international best practice to balance fairness, timeliness, and the public interest. This would help to deter opportunistic and speculative tendencies with respect to compensation paid to people affected by public infrastructure projects.
iv. Building a Project Information Management (PIM) system will take time and will have to align a medium to long-term strengthening of capacity with strengthening of institutions, regulations, guidance and manuals and stakeholder support. A reform action plan for PIM should center on clear performance indicators for results and progress to allow for flexibility in how results are achieved in this process.

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Edwin Gwaro Ototo contributed to this manuscript as the researcher and writer on methodology, data analysis and results presentation.

Matilda contributed to this manuscript as both the research expert and reviewer on land acquisition subject matter.

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14. ADDITIONAL READING

There should be an additional reading on how wayleave acquisition is undertaken in different jurisdiction and how resettlement is done

15. KEY TERMS AND DEFINITIONS

Land: any part of specified area on the ground defined by its boundaries and affected to a qualified activity.

Technical efficiency: Denotes effectiveness with which a given set of inputs is used to produce an output given as set of constraints in an optimal way.

Wayleave: Right of way created for the benefit of the national government or county government, a local authority, a public authority, or any corporate body to enable all such institutions, organizations, authorities, and bodies to carry out their functions

16. APPENDIX

Appendix 1. Descriptive statistics of variables

Voltage kV = 132

Variable	DMU	Mean	Std. Dev.	Min	Max
Length (km)	16	76.757	56.903	5	233.64
Project Cost (USD Millions)	16	2.335	1.794	0.163	6.8
No of Parcels	16	732.063	719.517	1	2840
Size of Wayleave trace (Ha)	16	211.606	164.834	15	700.92
No of Registered Easements	16	300.188	288.649	1	1079

Voltage kV = 220

Variable	DMU	Mean	Std. Dev.	Min	Max
Length (km)	4	129.21	143.263	6.75	328.5
Project Cost (USD Millions)	4	4.874	3.631	1.56	9.946
No of Parcels	4	809.5	1131.53	0	2400
Size of Wayleave trace (Ha)	4	519.237	573.2	27	1314
No of Registered Easements	4	347	507.768	0	1076

Voltage kV = 400

Variable	DMU	Mean	Std. Dev.	Min	Max
Length (km)	5	278	179.214	96	482
Project Cost (USD Millions)	5	15.806	10.168	4.3	28.907
No of Parcels	5	1921.4	1087.223	273	2820
Size of Wayleave trace (Ha)	5	1668	1075.281	576	2892
No of Registered Easements	5	938	778.875	91	1923

Voltage kV = 500

Variable	DMU	Mean	Std.	Min	Max
Length (km)	1	612	.	612	
Project Cost (USD Millions)	1	66.22	.	66.22	
No of Parcels	1	2631	.	2631	
Size of Wayleave trace (Ha)	1	3672	.	3672	
No of Registered Easements	1	1399	.	1399	