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NIXON LEMLEM, DR. MAKORI MORONGE

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DETERMINANTS OF OPTIMAL IMPLEMENTATION OF FIBRE OPTIC PROJECTS IN KENYA: A CASE OF LIQUID TELECOM KENYA

Nixon Lemlem[*1], Dr. Makori Moronge[2]

[*1]Msc. Candidate, Jomo Kenyatta University of Agriculture and Technology [JKUAT], Nairobi, Kenya
[2]Lecturer, Jomo Kenyatta University of Agriculture and Technology, [JKUAT], Nairobi, Kenya

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ABSTRACT

The purpose of this research study was to investigate determinants of optimal implementation of fiber optic projects in Kenya with reference to Liquid Telecom Kenya. This study would benefit the management of Liquid Telecom Kenya and other researchers by giving insights and recommendation on optimal optical fibre project deployment in Kenya. The researcher utilized descriptive research design with a target population of 120 employees comprising of the top, middle, and support staff levels of management. Sampling was not done being that the population was small. The survey consisted of census of all the 120. Questionnaires were used as the main data collection instruments and they were administered via drop and pick method. The gathered data was analyzed using descriptive statistics aided by Statistical Package (SPSS Version 21) and it was presented by use of both quantitative and qualitative analysis in form of frequency tables, pie charts, percentages and bar charts. It was notable that there existed strong positive relationship between the independent variables and dependent variable. The coefficient of determination (R^2) was used to measure how far the regression model's ability to explain the variation of the independent variables. The coefficient of determination was between zero and one. The data showed that the high R square was 0.769. It showed that the independent variables in the study were able to explain 59.20% variation in the implementation of the fibre projects while the remaining 40.80% was explained by the variables or other aspects outside the model. This implied that these variables were very significant and they therefore needed to be considered in any effort to boost implementation of fibre optic projects. The study therefore identified variables as critical determinants of implementation of fibre optic projects in Kenya.

Keywords: *Government Regulation, Financing, Management Support, Contract Management*

INTRODUCTION

In today's world, the transmission of information over both short and long distances is vital. Fiber optic cables play a key role in these transmissions, and will continue to do so as we move forward. Fiber optics refers to the technology of transmitting light down thin strands of highly transparent optical fibers, usually glass but sometimes plastic, using modulated light for signal transmission. Optical fibers used in communication are divided into two distinct groups based on design and installation namely "Outside plant" cable and "premise" cable. Outside Plant (OSP) fiber optics cables are installed outside buildings, as used in telephone networks, Cable television (CATV), metropolitan networks, utilities while the Premise fiber optic cable are installed in buildings and campuses (Hayes, The FOA Reference Guide to Outside Plant Fiber Optics, 2010). Deployment of outside Plant fibre optic cable is placed into four broad categories as defined by how the cable is installed. Underground cables are pulled in ducts buried under the ground, usually in larger ducts with inner ducts carrying one cable each. Direct buried cables are also underground, but rugged cables are buried without conduit. Aerial cables are strung on poles. Submarine cables are extremely rugged cables and are placed across seas using special cable laying ships for international communication across continents (Hayes, The FOA Reference Guide to Outside Plant Fiber Optics, 2010). In the United States many bodies are involved in the lifecycle of fiber optic projects. In Virginia State, one has to follow the laid down specifications by International Telecommunication union (ITU), Rural Utility services and advice of Society of Cable Telecommunications Engineers (SCTE). The Local governments also in most cases provide trenches within which the cables will be laid in different conduits upon payment of some fees. For example Santa Monica, an affluent community along the western edge of Los Angeles County has adopted a strategy for building a municipal fiber network that virtually any city should find instructive. In 1998 Santa Monica unveiled a concrete yet visionary Telecommunications Master Plan that led it to adopt an incremental approach to fiber optic network construction. The result has been one of the most successful "dig once" policies in the United States, reducing the cost of laying fiber by up to 90 percent by coordinating fiber and conduit installation with other capital projects or in joint trenching with other entities (Institute of Local Self-Reliance, 2014). The overall standards are provided by American National Standards Institute (ANSI) (Mauriello, 2012).

In a Southern African context, the greatest challenge to building these networks is permitting from regional governments. Liquid Telecom is a company that has deployed over 22,000 km of fibre networks in countries such as South Africa, Zimbabwe, Zambia, the DRC, and all of East Africa. The company in 2016 announced the launch of Liquid Sea, a submarine cable system, which will connect Europe to the East and Southern parts of Africa, as well as the Middle East. According to Willem Marais, Group Managing Executive from Liquid Telecom, "Every country has its specific challenges and idiosyncrasies. Probably the most important factor is to ensure that you are able to get the required licenses to operate telecommunication services within a specific market." (Sheldon, 2016). Liquid Telecom has built Africa's largest single fibre network, currently stretching across Uganda, Rwanda, Zambia, Zimbabwe, Botswana, DRC, Lesotho and South Africa (Liquid Telecommunications , 2017).

Government of Kenya embarked on implementation of a National Optic Fibre Backbone

(NOFBI) project aimed at ensuring connectivity in all the 47 counties of Kenya. The implementation of this project aims to ease communication across counties as well as improve government service delivery. The project which is at its completion stages now was implemented in two phases. Phase 1 of the project was completed in 2009 and established a National Optic Fibre Backbone Infrastructure with access points in most of the district headquarters and some border towns. Fibre backbone passes through 58 towns in 35 counties across Kenya with 4,300 km. This phase is already in use by the national government, and in firms such as Telkom, Safaricom, Jamii Telecom and KENET, utilizing more than 3,000km of the cable. NOFBI Phase 2 which was to further increase the coverage and safety protection of the existing transmission network, so as to enable the local government departments of the 47 counties to form an efficient transmission network with the central government began construction of in September 2014; To date only 1,200km out of the 1,600km civil works are completed and 900km of fibre has been laid in the backbone section. Metropolitan fibre civil works has also been completed in 35 of 47 counties. This project is being realised through collaboration of different stakeholders namely the Chinese Government which provides funding, Ministry of ICT which provides oversight role, ICT Authority as the implementing agency, Huawei as the building contractor of the national fiber optic infrastructure and Telkom Kenya. Telkom Kenya role is to operate and maintain of the cable through the ministry of ICT (ICT Authority, 2017).

Statement of the Problem

There are a number of infrastructure sharing models that would lead to savings on fibre optic infrastructure implementation these including shared trenches, shared ducts, shared cable, shared fibre and shared wavelength or packets. In shared trenches, operators come together and share the cost of civil works but each of the operators or service providers can install their own ducts and cable. This model significantly lead to cost savings in civil works while maintaining each operator's independence and flexibility to install whatever cable and optical fibre of their choice. The shared trench model is already being implemented by a number of operators, including MTN, Vodacom and Neotel in the National Long Distance (NLD) in South Africa. A consortium of operators in Tanzania, Airtel, Tigo and ZANTEL, have used a similar model to deploy metropolitan fibre optic networks. Shared ducts model leads to savings in the cost of ducts and share fibres (ICT Africa, 2017).

Despite availability of these infrastructure sharing options implementation of optical fiber in Kenya has been vertically integrated where one operator deploys, owns and operates own fibre optic infrastructure. In this model all network operators deploy individual fibre infrastructures along the same routes. According to studies based on recent projects in Kenya with this model it could cost the operator up to $200 million for a 1000km link, a large part of the cost is in civil works, or trenching. In the case of cable deployed underground it could cost up to 80% or $160 million in civil works alone on a 1000km link. If you have three operators trenching along the same route, the total cost of civil works alone could go up to $480 million (ICT Africa, 2017). This is due to lack of infrastructure sharing framework and policy.

There was also lack of unified right of way framework in Kenya. Before deployment of any fiber optic project is done the service provider is required to seek for right of way from relevant road authority and county government, owing to bureaucracy and different legislative framework the charges for right of way are often not uniform and approval timelines tend to take too long and this result to delay in project implementation, missed delivery dates and lost opportunity in the event that

customers churn before or in the middle of project implementation.

Lack of prober road development and expansion plans within the country has also led to uprooting and cutting of the already installed cables during road expansions or sewer line extension, this has resulted to massive loss of investment due to network outage, replacement of damaged cable and high cost of operations for service providers.

General Objective

The General objective of this project was to establish determinants of optimal implementation of fibre optic projects in Kenya. The Specific Objectives were:

- To establish the effect of government regulation in optimal implementation of fiber optic projects in Kenya
- To find out the effect of Financing in optimal implementation of fiber optic projects in Kenya
- To examine how management support affect optimal implementation of fiber optic projects in Kenya
- To determine how project contract Management affect optimal implementation of fiber optic projects in Kenya

LITERATURE RIVIEW

Theoretical review

Public Interest Theory

Public interest theory, developed by Arthur Cecil Pigou in 1932, posits that government regulation will be used as an instrument to correct market failures and improve public welfare (Post, 2011). Studies have shown that behind each scheme of regulation could be discerned an industry imperfection - the existence of which supplies a complete justification for some regulation assumed to operate effectively and without cost. The Public Interest theory assumes that the economic markets are very fragile and they have a tendency to operate inefficiently and in favor if individual's concern while ignoring the importance of the society as a whole (Young, 2013).

This theory has been used in this study because it explains government's interventions such as the laying out of standards and procedures for deployment of fibre optic project can be viewed as responses of government to public demands for the rectification of palpable and remediable inefficiencies in the sector. Therefore, substandard deployment of fiber cable projects, cases of vandalism and cable cuts during laying down of second provider cable, damage of cables due to road corridor expansion and delayed project implementation due to lack of permits for right of way as well as resistance to progress and change, are some of the reasons that necessitate the need for some controls. Government regulations in this case benefit the public in form of infrastructure sharing, environmental concerns being addressed and an organized way of infrastructural deployment being observed. According to the theory, the Kenyan public thus benefits from government intervention in issues such as infrastructure sharing, passing of critical installation bill to protect already deployed cables from vandalism. The government policies aid in defining how right of way is granted and optimal management of way leave space. This theory supports government regulation variable.

Financial liberalization theory

The theory of financial liberalization, associated to Mckinnon and Shaw, is based on the premise that the higher the real rate of interest, the greater the degree of financial deepening, the more saving there will be, and financial saving will be allocated and invested more efficiently than if saving is invested directly in the sector in which it takes place, without financial intermediation (Mckinnon 1973; Shaw 1973). According to McKinnon financial

saving is necessary for investment and consequently for growth. In emerging markets, saving resources exist but are badly managed. Based on the theory, companies remove or loosening of restrictions imposed by the government on the domestic financial market. This theory has been selected for the study as it explains performance of Telcom Ltd in implementing fibre optic.

The development of infrastructure projects is a complex and resource-intensive process. It is possible, however, to analyse all projects in terms of a common life-cycle which comprises a series of stages. Although the economic and financial evaluation of the project is probably the most obvious element of the feasibility stage, external factors can play a major role in determining whether a project will proceed. The structure and form of finance will be influenced by the nature of the project. For some projects, the majority of funding will come from local or central government sources; in other cases the project will be revenue-generating and this revenue will be used to pay back loans and pay for maintenance and operation. Some projects may also involve a private sector contribution in which the private sector aims to own and control some or all of the assets. This theory supports financing variable.

Management Systems Theory

Management systems theory notes that organizations are not natural as with mechanical or biological systems; they are contrived (Kerzner, 2013). According to the theory, organizations have structure or boundaries, but the structure of events rather than physical components. Furthermore, systems theory evolved from the basic sciences but is utilized in the social sciences including management theory. A system composed of interrelated and interdependent parts arranged in a manner that produces a unified whole is critical in understanding all parts of the emergency management process. Viewing organizations as complex open systems which interact with their environment provides such a critical view of the management system (Barnard, 1938).

Management systems theory is based on the idea that everything is part of a larger, interdependent arrangement and is centered on clarifying the whole, its parts, and the relations between them (von Bertalanffy 1972). This theory supports Management support variable.

Principal-agent theory

The principal-agent theory has been successfully applied to the research of management of contract projects. It has focused on the relationship between the project owner as principal and the contractor as agent. Also, the relationship between the contractor as principal and sub-contractors as agents has been explored. Principal Agency Theory (PAT) concerns the consummation of exchanges in a bipartite relationship (Eisenhardt, 1989). The theory uses the metaphor of a contract to conceptualise three problems that arise from a principal delegating and entrusting work to an agent, over whom the principal has little direct oversight (Bergen et al., 1992; Eisenhardt, 1989). AT attempts to provide insights into the conflicting roles of principal versus agent in terms of personal motivation, risk taking, ethics and information to determine the most efficient contract for the principal to govern the relationship in the face of these asymmetries. Agency has also been employed as a lens through which to understand governance practices (Heracleous and Lan, 2012), the role of the board in principal-agent constructs (Lan and Heracleous, 2010) and as a means of understanding the performance and operation of boards (Huse, MHoskisson, Zattoni, and Vigano, 2011). This theory has been used for this study to support project contract management theory.

Conceptual Framework

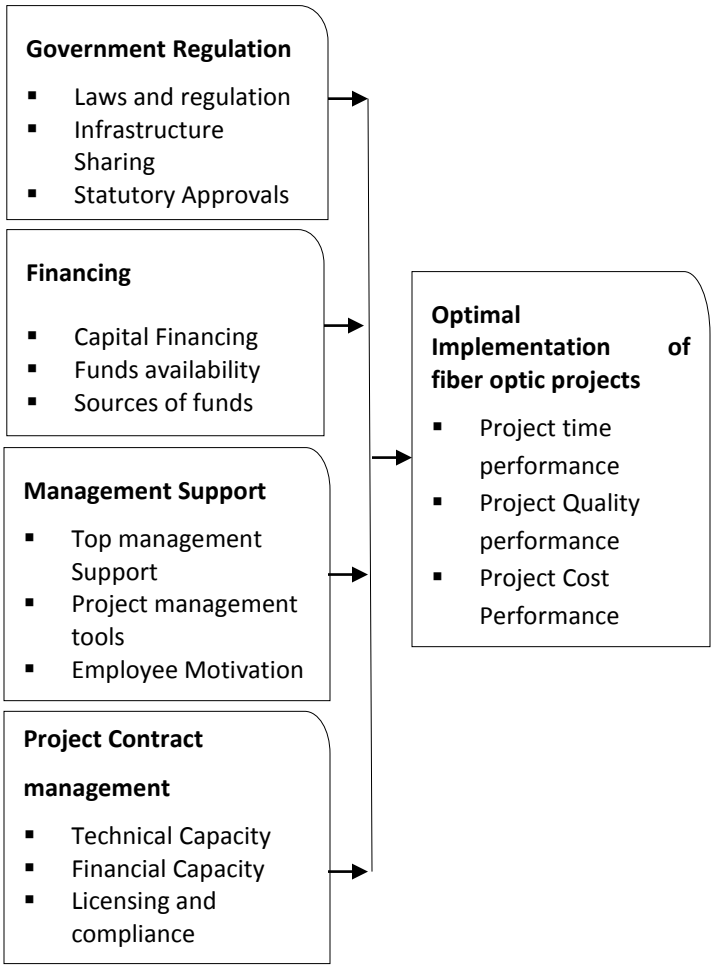

Figure 1: Conceptual Framework

Government Regulation

Regulations are issued by various national government departments and agencies to carry out the intent of legislation enacted by the parliament. Regulation is described as the rules maintained by authorities. Regulations are drafted, maintained and enforced by the government or its bodies. The aim of regulations is to provide order and a fair playing ground for all citizens and organizations. The fiber optic network projects space also need regulation. The lack of policy on implementation of fibre optic has given loopholes which can be exploited by unethical competitors to harm each other.

Financing

Financing is the act of providing funds for business activities, making purchases or investing. The Kenyan government has initiated some capital investment towards set up and installation of ICT infrastructure. Funding for these investments is achieved through partnerships between the government and development partners. The foreign funding component constitutes the largest percentage of this investment in terms of technology.

Management Support

Management support systems can be used and designed as a part of a company's quality management system and that can be integrated with the general company-wide information system to provide useful, timely and precise quality information. In the implementation of fibre optic, management support plays an important role in supporting quality management by delivering information to the right people at the right time, enabling the right action to be taken.

Project Contract Management

Project contracting means selecting organizational and contractual policies required for the execution of a specific project. The development of the contract strategy comprises a complete assessment of the choices available for the management of design and construction to maximize the likelihood of achieving project objectives. Projects often require complex contractual agreements between the party who owns the project and the party who executes the project. The design of such contractual agreements can be a daunting task for the project owner, who has much to lose by handing over the control over the project to a contractor who has an inherently different set of motivations.

Empirical review

Government Regulation

Finnish researchers have theoretically shown that the autonomy of a project (how independent the project is of base organization and stakeholders) affects its strategy and consequently the way it approaches its work (Artto *et al*., 2008). Turner (2002) reveals that successful project implementation is a result of setting clear goals, objectives and management and organizational construction. Simon *et al*. (1950), observed that in the broadest sense "efficiency" is "often used as a virtual synonym for rationality" (p. 490). This helps us connect this noble concept with project success. They further noted that the rational model views the organization as an instrument of efficiency, a deliberate and rational means for attaining known goals. However, Basu, (2004) argues that bureaucratic government systems, standards and complex approval procedures have taken a risk common to projects in developing countries. In Uganda, most of the base project organizations are government units, departments or ministries and bureaucratization might pose some challenges on project outcomes (Dubash, & Morgan, 2013; Schindler and Eppler, 2003). The current study would like to extend the view on what is determining how project management is carried out.

Financing

Previous studies have shown that successful implementation of fiber optic cable projects in Kenya has been hindered by several things. For example the high cost of capital expenditure involved in the implementation of the projects (Ndungu, 2010). Similarly, the financial investment required to implement the projects is huge as demonstrated by investment of 130 million dollars for the team's project. The acquisition of KDN Ltd by Altech Ltd was partly linked to the financial losses occasioned by the investment of around 50 million US dollars into its fiber project which did not achieve the projected return on investment (Okuttah, 2012).

The study of Banam (2010) analyzed the impact of financial liberalization on economic growth in Iran through Johansen Co-integration test using time series data from 1965 to 2005 while also investigating the determinants of economic growth. The financial liberalization index was represented by the financial restraints index which includes interest rate controls, reserve requirements and directed credit multiplied by -1. The results suggest that financial liberalization has positive and statistically significant impact on economic growth measured by the gross domestic product in Iran.

According to Khan (2007), the quality of final fibre optic product is dependent on capital expenditure and hence operational expenditure is the financial investment put into the running of the project. Return on investment is a key measure for successful implementation of fiber optic projects. This is because the donor has to recover the investment put into the project. Depending on the business case, the measure of return on investment is usually expected within a specified period of time.

Governments of some European countries are heavily investing in optic networks, which are already integrated for general use by population – for example, the Netherlands has committed itself to 100 per cent optic networks – while other governmental investments are quite limited to the scientific community (eScience), for example Germany and Belguim, which are investing in projects designed to increase existing ICT capacity (Sharma, & Mohr, 2008; Adeyemo, 2011). In addition to the infrastructure-related projects, countries of the Northern Sea Region (Belgium, Denmark, Sweden and UK) are implementing different strategies which are designed to increase

the up-take and use of broadband through the encouragement of competition. For example, Belgium in 2006-2007 had a project called "Internet for all" that aimed to encourage the use of broadband.

Management Support

Turner and Muller (2010) mentions that project success factors had ignored the qualities of project manager and it was concluded that the competence of the project manager has a measurable impact on the performance of the project. Also the research by Muller and Turner (2010) indicated that engineering and construction projects need project managers with qualities such as conscientiousness and transactional styles leadership. Burn (1978) mentions that transactional leadership is all about the exchange between the leader and subordinate cited in Aronson (2001). This appears suitable for short term benefits which are more valued in constructions. However Conger and Kanungo (1998) mentions that "transactional leadership is not at all a leadership, but just a managerial quality" cited in Aronson (2001). Snowden and Boone (2007) mentions that effective leaders change their decision making styles and their research indicated that in complex situation, decision making involves, probing, respond, create environments, increase levels of interactions for achieving goals.

Recent research has also looked into differences by nationality. Wang and Huang (2006) showed success is differently determined in China than in the mainstream project management literature. Contrary to the emphasis on time, cost, and quality criteria, Chinese stakeholders and project managers emphasize the importance of relationships as the main criterion for overall success in construction projects. Research focusing on the IT industry in India identified scope, and specifically functionality within scope, as the foremost success criteria (Agarwaland Rathod, 2006).

Project Contract Management

Previous studies have indicated that contractual arrangement in telecommunication has undergone various phases of its development based on contracting criterion such as sharing of risk and rewards, resource sharing and the level of participation. Contractual structure in telecommunication varies with the fibre optic, technological development, the extent of market development and the socio-economic environment (Shevchenko, Camci-Unal, Cuttica, Dokmeci, Albert, & Khademhosseini, 2014). The process of development of contracting has results in three distinct forms of fibre optic contract structure: tenant-based contracting, market or product-based contracting and vertical coordination and integration. In recent years, another dimension has been added to the concept of integration, namely, the formal share of risk and rewards among the actors involved in the construction process. This is the case in Project Alliances and Integrated Project Delivery contracts that include a multiparty agreement to specify the share of risks and rewards between the actors involved (El Asmaret al. , 2013; Lahdenperä, 2012).

MacNeil (1978) categorizes different contracts on the basis of economic rationality and legal issues involved in contract design and their implementation. He classifies various contracts as: classical contracts, neoclassical contracts, and relational contracts. Classical contracts, according to MacNeil, are the most inflexible ones. Legally and formally, these contracts are not open to further negotiations. Neoclassical contracts are characterized as flexible and the contract's structure enables the contracting parties to make appropriate adaptation at any time in response to unexpected external environmental changes. Unlike previous two types of contracts, relation contracting lacks a commonly accepted definition (Drescher, 2000). According to MacNeil (1978)

relational contracts include “an adjustment process of a more thoroughly transaction-specific and ongoing-administrative kind.

Saqib, Farooqui, and Lodi (2008), found out that procurement related factors such as project delivery system, project bidding method and project contract mechanism were rated as most significant factors and procurement related factors were rated among the top five critical success factors categories in Pakistan (Saqib, Farooqui, and Lodi (2008). They suggest that there is a need for further study regarding research on procurement and project success in Pakistan which will be useful in implementing projects successfully (Saqib et al., 2008). Khan, Jamil, and Sattar, (2008), states that much of the research remains to be done on the link between procurement of projects and its effective implementation in Pakistan. They expect that further research could reveal more prospective information on the existing mechanisms of procurement of projects and the means for improving the implementation of projects to achieve successful outcomes for the benefits of all the stakeholders and general public (Khan, Jamil, and Sattar, 2008).

METHODOLOGY

The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data. The target population was expected to provide adequate information that can be used effectively to draw conclusions on the topic. Prior to data collection approval was sought to conduct the proposed study from the university and the management of the company under study. The collected data was sorted, cleaned and coded.

RESULTS AND DISCUSSIONS

Implementation of Fibre Optic Projects

The study sought to examine the determinants of optimal implementation of fibre optic projects in Kenya, attributed to the influence of government regulation, project financing, and project management support and project contract management. The study was particularly interested in three key indicators, namely implementation within budget, schedule and scope, with all the three studied over a 5 year period, running from 2012 to 2016. Table 1 below presents the findings.

Findings in Table1 revealed improved implementation county government construction projects across the 5 year period running from the year 2012 to 2016. Implementation of projects within budget recorded low positive growth with a majority affirming to less than 10% in 2012 (38.7%) and 2013 (39.8%), to 10% in 2014 (30.9%) then more than 10% in 2015 (32.4%) and 2016 (30.4%). A similar trend was recorded implementation of projects within scope, growing from less than 10% (32.8%) in 2012, to more than 10% in 2013 (28.3%), 2014 (28.5%) and 2015 (27.3%). Implementation of projects within schedule further recorded positive growth with a majority affirming to less than 10% in 2012 (38.9%) and 2013 (33.8%), to 10% in 2014 (22.5%) and 2015 (32.5%) then by more than 10% in 2016 (32.8%). It can be deduced from the findings that key implementation of fibre optic projects indicators have considerably improved as influenced by among other attributes, the influence of government regulation, project finanacing, project management support and project contract management. Implementation of projects in time, implementation of projects within budget and implementation of projects within scope have particularly improved by at least 10 percent.

Table 1: Implementation of Optic Fibre Projects

Implementation within Budget	**2012**	**2013**	**2014**	**2015**	**2016**
Increased by less than 10%	38.7	39.8	30.9	32.4	30.4
Increased by 10%	32.8	28.3	28.5	27.3	28.5
Increased by more than 10%	28.7	32.1	40.3	40.9	41.5
Implementation within Scope	**2012**	**2013**	**2014**	**2015**	**2016**
Increased by less than 10%	38.9	33.8	22.5	32.5	32.8
Increased by 10%	35.8	35.8	31.9	33.9	30.9
Increased by more than 10%	25.6	30.8	45.9	35.4	35.9
Implementation within Schedule	**2012**	**2013**	**2014**	**2015**	**2016**
Increased by less than 10%	37.9	35.9	31.2	25.7	33.1
Increased by 10%	36.2	31.3	35.9	35.3	30.7
Increased by more than 10%	25.9	32.8	32.9	39	36.2

Government Regulation

The study sought to assess the influence of government regulation on implementation of optimal fibre projects in the study area. This section presented the findings to statements posed in this regard with responses given on a five-point likert scale (where 5 = Very Great Extent; 4 = Great Extent; 3 = Moderate Extent; 2 = Small Extent; 1= Very Small Extent). Table 2 presented the findings. The scores of 'Very Great Extent' and 'Great Extent' have been taken to represent a statement not agreed upon, equivalent to mean score of 3.5 to 5.0. The score of 'Moderate Extent' has been taken to represent a statement agreed upon moderately, equivalent to a mean score of 2.6 to 3.4. The score of 'Small Extent' and 'Very Small Extent' have been taken to represent a statement highly agreed upon equivalent to a mean score of 1.0 to 2.5

The study findings in Table 3 indicated that the respondents indicated to a great extent that the Government can improve on implementation of fiber optic projects by curbing some regulations. (3.654); Having a unified time for way leave approvals will improve implementation of fiber projects (3.234); Infrastructure sharing policy can led to optimal implementation of fiber optic projects in Kenya (3.098).The study findings corroborates with literature review by Okafor (2005) who observed that when government regulation is important on the implementation of the telecommunication infrastructure construction projects.

Table 3: Government Regulation

Statement	**N**	**Mean**	**Std**
Government can improve on implementation of fiber optic projects by curbing some regulations.	35	3.654	.234

Having a unified time for way leave approvals will improve implementation of fiber projects	45	3.234	.233
Infrastructure sharing policy can led to optimal implementation of fiber optic projects in Kenya	33	3.098	.431
Composite Mean		**3.345**	

Project Financing

The study sought to assess the influence of project financing on implementation of optimal fibre projects in the study area. This section presented the findings to statements posed in this regard with responses given on a five-point likert scale (where 5 = Very Great Extent; 4 = Great Extent; 3 = Moderate Extent; 2 = Small Extent; 1= Very Small Extent). Table 4 presented the findings. The scores of 'Very Great Extent' and 'Great Extent' have been taken to represent a statement not agreed upon, equivalent to mean score of 3.5 to 5.0. The score of 'Moderate Extent' has been taken to represent a statement agreed upon moderately, equivalent to a mean score of 2.6 to 3.4. The score of 'Small Extent' and 'Very Small Extent' have been taken to represent a statement highly agreed upon equivalent to a mean score of 1.0 to 2.5

The study established that a majority of respondents to a moderate extent that the there was adequate quality control costs in the project (3.658); there was adequate purchase of equipment costs in most of the projects (3.342); there was adequate administration costs in the project (3.032); effective are the internal controls on the cost overruns (3.498); the administration costs affect compliance of quality in the projects (3.460); the projects' purchase of materials costs lead to time and cost overruns (3.223). The study findings are in line with literature review by Kaliba, Muya, & Mumba (2009 who observed that the required project funding is necessary for the management of the projects. There is need to have adequate project funding and financial control mechanisms which can lead to quality management of the projects.

Table 4: Project Financing

Statements	Mean	Std. Dev
Are there adequate quality control costs in your project?	3.658	.087
Is there adequate purchase of equipment costs in your project?	3.342	.068
Are there adequate administration costs in your project?	3.032	.086
Do you have adequate record keeping on control of material costs in the project?	3.498	.023
Do administration costs affect compliance of quality in the projects?	3.460	.056
Does the projects' purchase of materials costs lead to time and cost overruns?	3.223	.079

Project Contract Management

The study sought to assess the influence of project contract management on implementation of fibre optic projects in the study area. This section presented findings to statements posed in this regard with responses given on a five-point likert scale (where 5 = Very Great Extent; 4 = Great Extent; 3 = Moderate Extent; 2 = Small Extent; 1= Very Small Extent). Table 5 presents the findings. The scores of 'Very Great Extent' and 'Great Extent' have been taken to represent a statement not agreed upon, equivalent to mean score of 3.5 to 5.0. The score of 'Moderate Extent' has been taken to represent a statement agreed upon moderately, equivalent to a mean score of 2.6 to 3.4. The score of 'Small Extent' and 'Very Small Extent' have been taken to represent a statement highly agreed upon equivalent to a mean score of 1.0 to 2.5. The study findings in Table 5 the respondents indicated to a great extent that Project had a documented contract review process (3.432); Project had a risk management plan (3.651); Project had an insurance policy plan (3.827); Requirements review was conducted in the procurement process (3.927); Contracts are awarded competitively (3.581); Tenders were evaluated before awarding (3.750); Contracts had respective project managers (3.903); All project contracts were subjected to Inspection(3.341).

The study findings were in agreement with literature review by Walter (2011) who found out that public projects need to examine and, where appropriate, adopt contemporary procurement delivery strategies such as alliance contracting (simple alliances; design, construct and maintain alliances; structured alliances; and programs of alliances).approaches include sole invitees, early contractor involvement, multi-agency contract bundling, end-to-end contract bundling, design consultancies, public private partnerships (PPPs), and proposal management consultancies. Contracts can be well managed by the foundation of a successful spend intelligence system is standardized product and vendor coding, coupled with the automatic capture, processing, and presentation of information for use by decision makers for the successful implementation of the county government projects.

Table 5: Project Contract Management

Statement	N	Mean	Std
Project has a documented contract review process	35	3.432	.367
Project has a risk management plan	29	3.651	.231
Project has an insurance policy plan	28	3.827	.561
Requirements review is conducted in the procurement process	33	3.927	.316
Contracts are awarded competitively	35	3.581	.651
Tenders are evaluated before awarding	30	3.750	.623

Contracts have respective project managers	29	3.903	.741
Project has a competent contract management team	31	3.431	.378
All project contracts are subjected to Inspection	32	3.124	.238
Composite Mean		**3.009**	

Multiple Regression Analysis

The study adopted a multiple regression analysis so as to establish the relationship of independent variables and dependent variables. The study applied SPSS to compute the measurements of the multiple regression analysis. According to the model summary Table 6, R was the correlation coefficient which showed the relationship between the indepedent variables and depedent variable. It was notable that there existed strong positive relationship between the indepedent variables and depedent variable as shown by R value (0.811). The coefficient of determination (R^2) was used to measure how far the regression model's ability to explain the variation of the independent variabies. The coefficient of determination is between zero and one. The data showed that the high R square is 0.769.It shows that the independent variables in the study were able to explain 59.20% variation in the implementation of the fibre projects while the remaining 40.80% is explained by the variables or other aspects outside the model.This implied that these variables were very significant and they therefore needed to be considered in any effort to boost implementation of fibre optic projects. The study therefore identified variables as critical determinants of implementation of fibre optic projects in Kenya.

Table 6: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.769	.592	.572	.010

F-Test Results

F-test was done to test the effect of independent variables on the dependent variable simultaneously. The F-statistic test basically shows whether all the independent variables included in the model jointly influence on the dependent variable. Based on the study results of the ANOVA Test or F-test in Table 7 obtained F-count (calculated) was 18.9933 greater the F-critical (table) (14.901) with significance of 0.000. Since the significance level of 0.000< 0.05 we conclude that the set of independent variables affect the implementation of fibre optic projects (Y-dependent variable) and this shows that the overall model was significant.

Table 7: ANOVA

Model	Sum of Squares	d.f	Mean Square	F	Sig.

Regression	12.453	4	3.113	18.9933	.000[a]
Residual	10.654	65	.1639		
Total	23.117	69			

NB: F-Critical Value = 14.901

The results of multiple regression analysis obtained regression coefficients t value and significance level as indicated in Table 8. The study conducted a multiple regression analysis so as to determine the relationship between the dependent variable and independent variables. From the study findings on the regression equation established, taking all factors into account (independent variables) constant at zero implementation of fibre optic projects was 15.678. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in government regulations will lead to a 0.882 increase in implementation of fibre optic projects; a unit increase in project financing will lead to a 0.760 increase in implementation of fibre optic projects, a unit increase in project contract management will lead to 0.722 increase in implementation of fibre optic projects and a unit increase in project contract management will lead to 0.700 increase in implementation of fibre optic projects. This infers that government regulation contributed most to implementation of fibre optic projects

Based at 5% level of significance, government regulation had a .000 level of significance; project financing show a .002 level of significance, project management support show a .023 level of significance and project contract management show a .032 level of significance hence the most significant factor was government regulation.

Table 8: Coefficient Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	β	Std. Error	**β**		
(Constant)	15.678	1.979		5.615	.000
X_1_GR	.882	.113	.465	6.795	.000
X_2_PF	.760	.114	.354	6.165	.002
X_3_TMS	.722	.115	.255	5.992	.023
X_4_PCM	.700	.121	.232	5.135	.032

The general form of the equation was to predict implementation of fibre optic projects from government regulation, project financing, project management support and project contract management is: ($\mathbf{Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon}$) becomes: $Y= 15.678+ 0.882X_1+ 0.760X_2+ 0.722X_3 + 0.700X_4$. This indicates that implementation of fibre optic projects = 15.678+ 0.760* Government regulation + 0.722*Project Management Support + 0.688*Project

Management Support + 0.700*Project Contract Management + 1.979

CONCLUSION AND RECOMMENDATIONS

The study sought to assess the influence of government regulation on implementation of optimal fibre projects in the study area. The study findings indicate that the respondents indicated to a great extent that the Government can improve on implementation of fiber optic projects by curbing some regulations. Having a unified time for way leave approvals will improve implementation of fiber projects. Infrastructure sharing policy can led to optimal implementation of fiber optic projects in Kenya. This implied that government regulation is important on the optimal implementation infrastructure construction projects.

The study sought to assess the influence of government regulation on implementation of optimal fibre projects in the study area The study established that a majority of respondents to a moderate extent that the there was adequate quality control costs, purchase of equipment and adequate administration costs in the project . To a small extent there were effective internal controls on the cost overruns. The administration costs affect compliance of quality in the projects and the projects' purchase of materials costs lead to time and cost overruns. The study established that the required project funding is necessary for the management of the projects. There is need to have adequate project funding and financial control mechanisms which can lead to quality management of the projects

The study indicated that the respondents stated to a great extent that project has a documented contract review process. The project has a risk management plan and insurance policy plan. The requirements review is conducted in the procurement process. The contracts are awarded competitively and the tenders are evaluated before awarding. The contracts have respective project managers. All project contracts are subjected to Inspection. This indicates that project contract management is important factor on the optimal implementation of the fibre projects.

The study sought to examine the determinants of optimal implementation of fibre projects in Kenya, attributed to the influence of government regulation, project financing, project contract management over a 5-year period, running from 2012 to 2016. Finish of the projects within schedule recorded a slow positive implementation. Finish of the projects within time further recorded a slow positive implementation. Finish of the projects within scope also recorded a slow positive implementation. From inferential statistics, a positive correlation is seen between each determinant variable and optimal implementation of fibre projects. The strongest correlation was established to be government regulation. All the independent variables were found to have a statistically significant association with the dependent variable at ninety-five level of confidence. Analysis of variance was further done to show whether there is a significant mean and all variables were found to be significant.

Conclusions of the Study

Based on the study findings, the study concludes that optimal implementation of fibre projects in Kenya is affected by the independent variables. The government regulation followed by project project financing, project contract management is the major factors that mostly affect optimal implementation of fibre projects in Kenya.

The study concludes that government regulation is the first important factor that influences optimal implementation of fibre projects in Kenya. The regression coefficients of the study show that

government regulation has a significant influence on optimal implementation of fibre projects in Kenya. This implies that increasing levels of government regulation would affect the optimal implementation of fibre projects in Kenya. This shows that government regulation affect optimal implementation of fibre projects in Kenya.

The study concludes that project financing is the second important factor that influences optimal implementation of fibre projects in Kenya. The regression coefficients of the study show that project financing has a significant influence on optimal implementation of fibre projects in Kenya. This implies that increasing levels of project financing would affect the optimal implementation of fibre projects in Kenya. This shows that government regulation affect optimal implementation of fibre projects in Kenya.

Further, the study concludes that project management support is the third is the important factor that influences optimal implementation of fibre projects in Kenya. The regression coefficients of the study show that project management support has a significant influence on optimal implementation of fibre projects in Kenya. This implies that increasing levels of project management support would affect the optimal implementation of fibre projects in Kenya. This shows that project management support affect optimal implementation of fibre projects in Kenya.

Finally, the study concludes that project contract support is the fourth is the important factor that influences optimal implementation of fibre projects in Kenya. The regression coefficients of the study show that project contract management has a significant influence on optimal implementation of fibre projects in Kenya. This implies that increasing levels of project contract management would affect the optimal implementation of fibre projects in Kenya. This shows that project contract management affect optimal implementation of fibre projects in Kenya.

Recommendations of the Study

There is need to ensure that there is adequate project financing to enhance completion of the projects in time. This will reduce budgetary constraints, cost overruns, reduces interference with implementation of the project schedule, and reduces insufficient capital to run project activities. The internal controls and record keeping are important to boost optimal implementatation of projects.

The study recommends that there is need to allow the project team members to have sense of belonging in the management of the affairs in the projects. They can carry out higher responsibilities with other leaders with little supervision. The organization should ensure that the orders are set and help team member to achieve our vision and mission. The leaders from every branch and the project team members (staffs) should be involved when important issues arise and retain decision making rights. The project contract management to a great extent influence implementation of ofprojects. There should be a continuous contract review process and ensure a project has a risk management plan and insurance policy plan. The requirements review should be conducted in the procurement process. The contracts should be awarded competitively and the tenders well evaluated before awarding, with the project contracts subjected to inspection.

Areas for Further Research

The study is a milestone for further research in the field of project management in Africa and particularly in Kenya. The findings have demonstrated role of government regulation, project financing, project contract management on the implementation of fibre projects. The current

study should therefore be expanded further in future in order to determine other factors that affect the implementation of fibre projects since the study 59.20% variation in the implementation of the fibre projects while the remaining 40.80% need a further research.Further, the existing literature indicates that as a future avenue of research, there is need to undertake similar research in other implementation of fibre projects other countries in order to establish whether the explored factors can be generalized.

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