Combined Influence of Operational, Credit, Liquidity and Environmental Risks on Water-Sanitation Infrastructure Investments in Kenya

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Abstract

The paper investigated the combined influence of Operational, Credit, Liquidity and Environmental risks on Water-Sanitation Infrastructure Investments in Kenya. The study focuses on 14 risks related to the water and sanitation infrastructure investments project life cycle. In particular, the study sought to find out whether operational risks, credit risks, liquidity risks and environmental risks influence water and sanitation infrastructure investments project in Kenya. The study adopted a mixed methodology research design where qualitative and quantitative research approaches are used to test the research hypotheses. From a target population of 127, Total Population Sampling (TPS) was adopted whereby the whole population was studied. Data was collected using structured questionnaire with Likert scale measurement. Both descriptive and inferential analysis methods were employed in the analysis. The results found out that operational risks (p-value 0.00), credit risks (p-value 0.00), liquidity risks (p-value 0.01) and environmental risks (p-value 0.00) were positive and statistically significant. The study recommends the need to consider the significant variables as they influence that water and sanitation infrastructure investments project life cycle.

Keywords: Operational Risks, Credit Risks, Liquidity Risks, Environmental Risks, Water and Sanitation Infrastructure Investments

Introduction

Operational risk has always been present, but in the last 20 years, with rapid changes in the financial industry leading to larger and more complex financial institutions, a wide spread concern has grown significantly. Jorion (2007) refers to it as the most adverse form of risk because of its contribution to numerous failures in financial institutions. The Basel Committee on Banking Supervision (2001) defines operational risk as the risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events. Operational risk is internal if the financial institution has control over it, and external if it is due to uncontrollable events such as natural disasters, security breaches, political risk (Hull, 2012). Sub-risks include Model risk whereby there is probability of loss resulting from the weaknesses in the financial-model used in assessing and managing a risk, people risk which arise when people do not follow the organization's procedures, practices and/or rules. Legal risk relates to the regulatory-risk where a transaction conflicts with a legislative policy. Political risks arise due to changes in government policies resulting to diverse impacts on investor.

The entire water sector focuses on sustaining economic development through investments in drinking water supply, sanitation services, wastewater management, and environmental protection and enhancement (ADB, 2009). Infrastructure investments decisions under Public Private Partnership Model include Build – Operate – Transfer (BOT), Build – Own – Operate (BOO), Build – Own – Operate – Transfer (BOOT), Design – Build – Finance (DBF), Design – Build – Finance – Operate (DBFO), Design – Construct – Maintain – Finance (DCMF). The value chain of the urban water supply and sanitation seen in figure 1.1 below experiences the risk of loss resulting from inadequate or failed internal processes, people, systems and from external events.

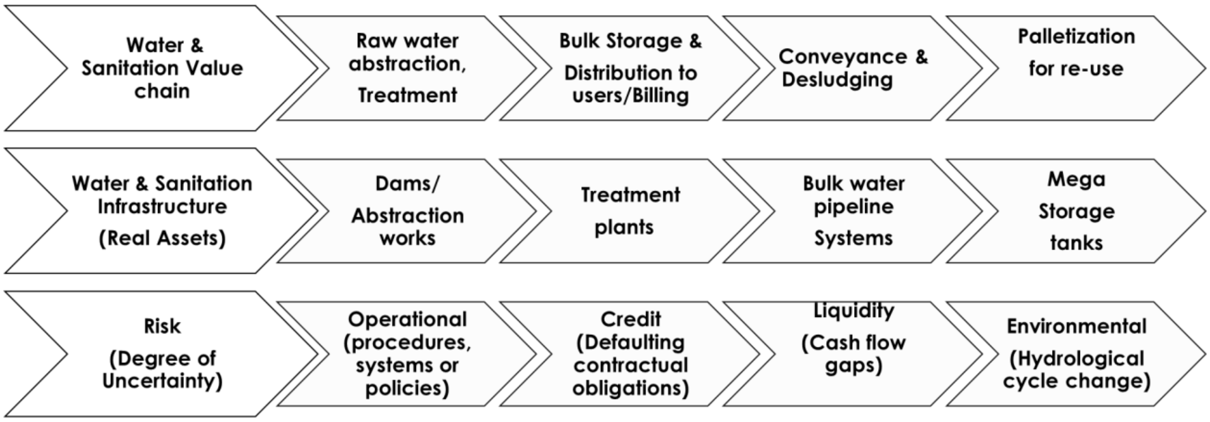


Figure 0: Value Chain of Water and Sanitation Infrastructure Investment
Source: Value chain of water supply sector based on ADB (2009)

Operational risks are better viewed as the risk arising from the execution of an institution's business functions. On the other hand, Credit risk is loss that may occur from the failure of any party to abide by the terms, conditions of any financial contract and make required payments on loans due to an entity (Duffie *et al.*, 2012). Sub-risks include exposure rate risk which arise from a potential change seen in the exchange rate of one country's currency in relation to another country's currency and vice-versa. Recovery rate risk occurs whereby there is a possibility that the principal and accrued interest on defaulted debt cannot be recovered by banks and non-banking financial companies (NBFC), sovereign risk occurs where a government is unable to meet its loan obligations.

Liquidity risks arise when an entity is unable to meet its cash and collateral obligations and threatens its financial position or existence (Lee, 2011). Sub-risks include asset liquidity risk which result from difficulty to dispose assets at their carrying value when needed. Funding liquidity risk result from failure to access sufficient funds to make a payment on time and when commitments made to customers are not fulfilled as discussed in the service level agreements.

The global financial crisis has led to increased funding costs for all projects and effects have been seen over many years. This means there are expectations that the number of completed infrastructure investments projects will decline substantially in the near future (Craciun, 2011). As a result of liquidity risks as shown in figure 1.2 below financing gaps are seen in rollout of water and sanitation infrastructure investments.

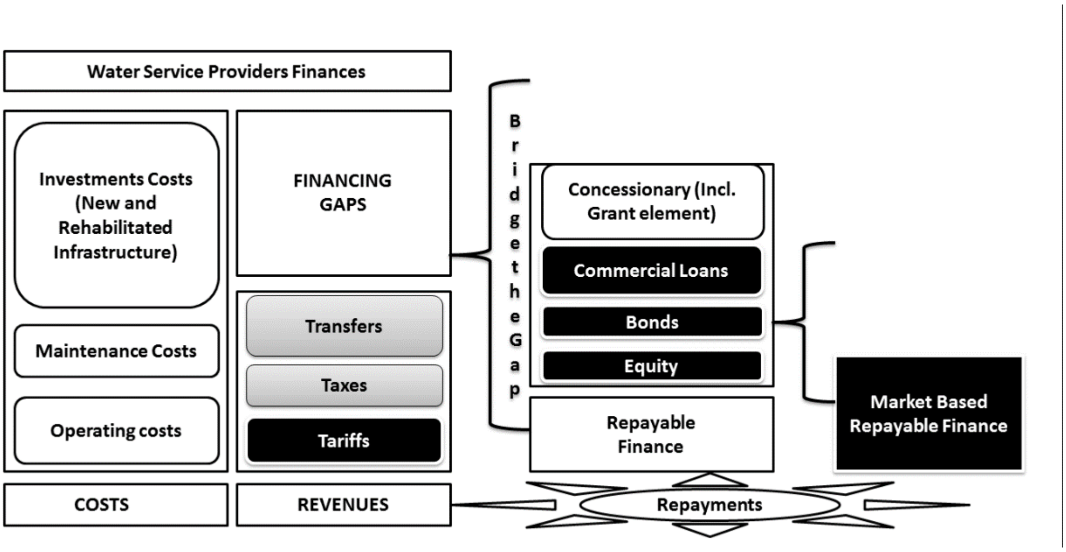


Figure 1: Financing Gaps in Water Supply Investments
Source: OECD (2010 b)

Environmental risks facing multipurpose dam development projects in the construction and operational phase countrywide have faced termination or complete overhaul. According to Wong, Roy and Duraiappah (2005), the available renewable water resources are insufficient to meet Kenya's water needs. Kenya is generally characterized as a water-stressed country (FAO,2005; Ohlsson & Appelgren,1998; UNEP,2006).

Globally, access to water and improved sanitation is critical as affirmed by the Millennium Development Goals, Agenda 63 of the African Union and Kenya Vision 2030. This has massive contribution towards averting health related costs. Thus, investing in the sector is critical. Based on tabled stakeholder briefs, governments and other stakeholders have continued to invest resources currently estimated at between $74 and $166 billion per year (Hutton & Varughese, 2016). The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) recently reported, 2.2 billion people lack access to safely managed drinking water services and 4.2 billion people lack safely managed sanitation services.

Around forty percent of the population in Sub-Saharan Africa (SSA) lack access to safe drinking water sources, while sixty-nine percent do not have access to improved sanitation facilities (Africa Development Bank, 2011). The situation is worse in rural areas, where fifty-five and seventy-six percent have no access to safe drinking water and adequate sanitation, respectively (Africa Development Bank, 2011). Low access to sanitation and water supply are considered to be root cause of many diseases affecting continent. Access to water and sanitation is a human right, yet numbers show no guarantee to all. By 2025, it is estimated that Africa's population will have grown to approximately 1.34 billion people, and with uneven distribution of water across the continent, where some areas are already suffering lack of fresh water availability, more than 25 African countries will be subject to water scarcity or water stress, with Northern Africa facing the worst predictions (African Development Bank, 2011).

Many governments have continued to invest in meeting this short fall. To meet the short fall, it is estimated that Africa's water needs is between US$50 billion to U$54 billion per year for each of the next twenty years (African Development Bank, 2011). Forecasts on annual spending required for the water sector reveal a sizeable financing gap and an increased need for non-traditional funding sources. Future annual spending on water supply and sanitation is estimated at US$ 21.9 billion, compared with current spending levels of US$ 7.6 billion (African Development Bank, 2011). The gap of US$14.3 billion, which accounts for approximately two percent of the total gross domestic product (GDP) in Sub-Saharan Africa, needs action more aggressively by concerned governments. In addition, cost recovery and subsidies need implementation by governments.

In Kenya, the drive towards improvement in water and sanitation infrastructure investments dates back in the late 1960s upon attainment of independent. This has seen investment in basic facilities including water and sewerage nationalized for purposes of improved economic access to water and sanitation services aimed at improving health outcomes (Nyanchaga, 2016). The sector however, continues to face risks as water and sanitation infrastructure investments targets especially in rural coverage is below the expectations as indicated in the Ministry's blue print. In the National Water Services Strategy, the government aimed at achieving 80% access to safe and reliable water for urban areas and 75% for rural areas by 2015 (Mwanajuma & Ngugi, 2014). The WASH joint monitoring programme report (2019) by The World Health Organization and UNICEF however show that only 59% of Kenyans have access to basic water services and only 29% have access to sanitary services.

In the analysis of the Kenya's water Act, for the rural poor in the management of water resources and delivery of water services, Mumma (2005) recognizing pluralistic legal frameworks is necessary for the effective delivery of water services to the rural poor. He noted that the Act, depends on state-based legal frame-works, whose effectiveness in meeting the needs of the rural poor is limited, particularly in terms of technical and financial resources the Kenyan state is facing. Additionally, the water and sanitation infrastructure investments sector continue to face Operational, Credit, Liquidity and Environmental risks both on a Global and on regional context.

The study sought to examine the combined influence of Operational risks, Credit risks, Liquidity risks and Environmental risks on water-sanitation infrastructure investment in Kenya.

Theoretical Review

Credit Risk Theory

In 1974, Merton proposed the Credit Risk model to assess the credit risk of a company's debt. Analysts and investors utilize the Merton model to understand how capable a company is at meeting financial obligations, servicing its debt, and weighing the general possibility that it will go into credit default. Water and sanitation Infrastructure investment risks need to be known and measured to the investors for purposes of forecasting returns. Financing mix of water service providers in the business of providing water and sanitation dictate their value to investors. The financing mix also assists in forecasting sales. Capital intensive projects undertaken by Firms in the business of providing water and sanitation need to be managed in such a way that there is plough back which dictates future cash flows. Breaking even for firms in the business of providing water and sanitation services need to be seen to ensure consistent going concern. Initial outlay need to be paid back first enough to pave way for profits.

The cost analysis is an incremental cost analysis, with estimation of the costs of extending coverage of water supply and sanitation services to those currently not covered (Haller *et al.*, 2008).Benefits of the water supply and sanitation improvements were classified into three main types: direct economic benefits of avoiding diarrhoeal disease; Indirect economic benefits related to health improvement; and non-health benefits related to water supply and sanitation improvement (Curry & Weiss, 1993; Hanley & Spash, 1993; Field,1997).

Cost Benefit Analysis (CBA) Theory

CBA Estimates and totals up the equivalent money value of the benefits and costs to the community of projects to establish whether they are worthwhile. Breaking even for firms in the business of providing water and sanitation services need to be seen to ensure consistent going concern. Initial outlay need to be paid back first enough to pave way for profits. The cost-benefit analysis (CBA) is the process used to measure the benefits of a decision or taking action minus the costs associated with taking that action. A CBA involves measurable financial metrics such as revenue earned or costs saved as a result of the decision to pursue a project.

Firms' liquidity position and relationships with financial institutions may affect the demand for trade credit. According to the pecking order theory, firms prefer first internal resources and then apply for external funding options. If trade credit comes lower down in the pecking order than borrowing from close financial institutions, it can be hypothesized that there is a negative relationship between the financial institutions or an available line of credit and the demand for trade credit.

Risks related to water and sanitation infrastructure investments demands higher interest financing. Liquidity Preference Theory suggests that an investor should demand a higher interest rate or premium on securities with long-term maturities that carry greater risk because, all other factors being equal, investors prefer cash or other highly liquid holdings.

Liquidity Theory of Credit

This theory, first suggested by Emery (1984), proposes that credit rationed firms use more trade credit than those with normal access to financial institutions. The central point of this idea is that when a firm is financially constrained the offer of trade credit can make up for the reduction of the credit offer from financial institutions. In accordance with this view, those firms presenting good liquidity or better access to capital markets can finance those that are credit rationed. Several approaches have tried to obtain empirical evidence in order to support this assumption.

Protection Motivational Theory (PMT)

Protection Motivation Theory (PMT) was developed by Rogers in 1975, to describe how individuals are motivated to react in a self-protective way towards a perceived health threat. Rogers expected the use of PMT to diversify over time, which has proved true over four decades. A revision of PMT (Rogers,1983) extended the theory to provide a more general account of the impact of persuasive communications, with an emphasis on the cognitive processes that mediate behavior change. Subsequent research on PMT has typically taken two forms: first, PMT has been used as a framework to develop and evaluate persuasive communications; and second, PMT has been used as a social cognition model to predict health behavior. The purpose of this paper is to explore how PMT relates to Environmental risks which consists Sediment Discharge risk, Effluent Discharge risk, Climate change risk and Catchment Degradation risk.

Methodology

Positivism was adopted whereby deductive reasoning was used to put forward theories that were tested by means of fixed, predetermined research design and objective measures. The study adopted a mixed methodology research design where qualitative and quantitative research approaches were used to test the research hypotheses. A causal design was used to measure the impact a specific change will have on existing norms and assumptions. The target population constitutes one twenty-seven (127) Government and Non-Government entities whose main mandate is water supply-sanitation (WSS) services in Kenya and are in charge of related infrastructure investments. Total population sampling was adopted whereby the whole population of interest in these case members who share a given characteristic was studied. It is most practical when the total population is of manageable size, such as a well-defined subgroup of a larger population. The total population sampling would be a good way to conduct a survey meant to get the opinions of different players in the Water Sanitation Infrastructure Investment space. In practice, total population sampling is done when the target group is small and set apart by an unusual and well-defined characteristic.

The questionnaires as one of the primary data collection tools were pilot tested and revised before they are used in the research project. The pilot and pretesting, followed by a through revision of the questionnaire will produce a much better measurement instrument that will cause far fewer problems during the research and will give more accurate results. Responses from questionnaires were coded with numbers. Since a scale was used, the numbers were the scale points. Numbers were arbitrarily assigned to nominal categories for questionnaire items that do not use magnitude-type measurement. These numbers are typically placed into fixed columns on one or more data lines. These data lines contain all the responses for a single questionnaire. For Secondary data a preliminary search for information was key, location of relevant materials, evaluation of sources, making notes and inclusion in the final project through proper citation of sources.

The study used the Test-Retest/Stability Reliability which compares results from an initial test with repeated measures later on, the assumption being that if the instrument is reliable there were close agreement over repeated tests if the variables being measured remain unchanged. The Kappa score, specificity, and positive predictive values (PPVs) were also used to measure reliability and validity, respectively. Reliability was tested using Cronbach‘s alpha. Cronbach‘s alpha is known as a good measure of reliability. The values of Cronbach‘s alpha ranges between 0 and 1 where the Cronbach‘s alpha values between 0.8 and 1.00 indicate a considerable reliability, values between 0.70 and 0.80 indicate an acceptable reliability while values below 0.70 are considered less reliable and unacceptable (Nunnally, 1978). In this study, Cronbach‘s alpha coefficient which is a measure of internal consistency was used to assess reliability. Findings indicate that operational risk had a coefficient of 0.944, infrastructure investments in Water and Sanitation had a coefficient of 0.960, firm size had 0.947, liquidity risk had 0.962, credit risk had a coefficient of 0.934, while environmental risk had a value of 0.946.This suggested acceptable levels of internal consistency. This implies that the items included in measuring different constructs were indicative of the same underlying disposition. Reliability of the constructs is shown in Table 1below.

Table 1: Reliability Test of Constructs

Variables	Cronbach's Alpha	Number of Items	Reliability
X_1-Operational risks	.944	23	Accepted
X_2-Credit risks	.934	17	Accepted
X_3-Liquidity risks	.962	7	Accepted
X_4-Environmental risks	.946	23	Accepted
M-Firm size	.947	11	Accepted
Y-Infrastructure Investments in Water and Sanitation	.960	8	Accepted

In order to test the causality and to determine the combined influence of operational risks, credit risks, liquidity risks and environmental risks on investment in water and sanitation infrastructure, regression model was used. This enabled to determine how the independent variables influence the dependent variable. The mode adopted was $Y=\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$

Where:

Y	=	Infrastructure Investments in Water and Sanitation
X_1	=	Operational Risk
X_2	=	Credit Risk
X_3	=	Liquidity Risk
X_4	=	Environmental Risk
α	=	The constant of regression
$\beta_1, \beta_2, \beta_3, \beta_4$	=	The sensitivity of Infrastructure Investments in Water and Sanitation to the independent variable i (coefficients of the independent variables)
ϵ	=	The error term.
$\beta_{\dot{0}}$	=	The Constant

Tested Assumptions of Linear Regression

Tests conducted included normality tests, Homoscedasticity, linearity and multicollinearity. The results summarized in Table 2 indicate Skewness was between -2 to +2 and Kurtosis between -7 to +7. Correlation coefficient was less than 0.7 indicating lack of Multicollinearity. The data distribution has a very tight distribution to the left of the plot, and a very wide distribution to the right of the plot an indication that the data is not homoscedastic. The predictor variables in the regression have a straight-line relationship with the outcome variable.

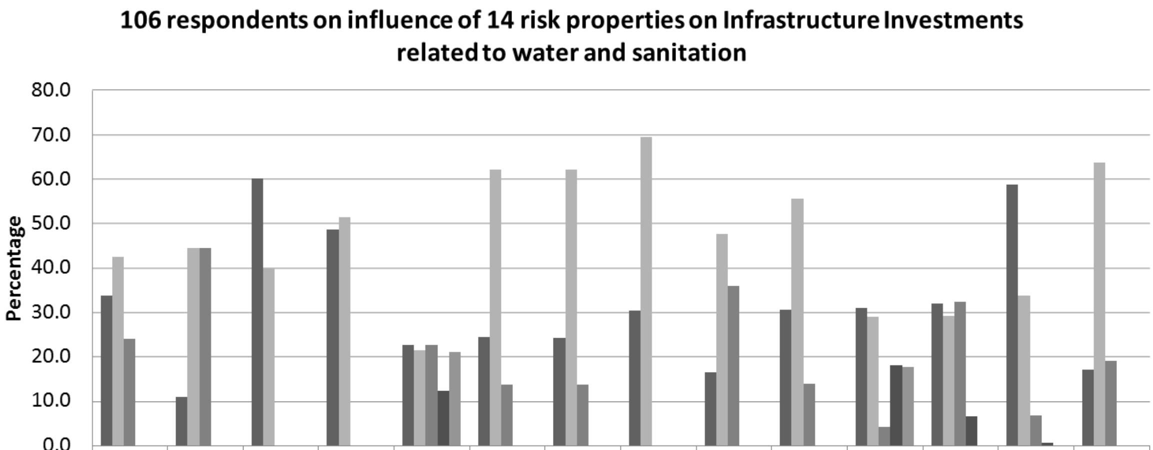
Table 2: Tested Assumptions of Linear Regression

Risks	**Normality tests**		**Homoscedasticity test**	**Linearity test**	**Multicollinearity test**
	Skewness	**Kurtosis**			
Operational Risks	Y (-0.28) X1(-0.55)	Y (-1.22) X1(-0.16)	From the plot the data is not homoscedastic. The data distribution has a very tight distribution to the left of the plot, and a very wide distribution to the right of the plot.	The predictor variables in the regression have a straight-line relationship with the outcome variable.	Ranges between -0.30829 to 0.55737
Credit Risks	Y (-0.28) X1(0.25)	Y (-1.22) X1(-1.14)			Ranges between 0.119325 to 0.54622
Liquidity Risks	Y (-0.28) X1(0.04)	Y (-1.22) X1(0.99)			Ranges between -0.37005 to 0.25353
Environmental risks	Y (-0.28) X1(-0.60	Y (-1.22) X1(-0.17)			Ranges between -0.37 to 0.1

Findings

106 respondents on influence of 14 risk properties related to Operational risks, credit risks, Liquidity risks and Environmental risks on infrastructure investments in water and sanitation are indicated in figure 4.

From the five point Likert scale, respondents agreed on the influence of model risk at 76.1%, people risk at 55.4%, legal risk at 100%, political risk at 100%, exposure rate risk at 44% , recovery rate risk at 86.4%, sovereign risk at 100%,settlement risk at 100%, asset liquidity risk at 64.1%, funding liquidity risk at 86.3%, sediment discharge risk at 60%, effluent discharge risk at 61.1%, climate change risk at 92.6% and catchment degradation risk at 80.9%.



	mo	pe	le	po	ex	re	so	se	as	fu	sed	eff	cl	ca
sa	33.6	10.9	60.1	48.6	22.6	24.3	24.2	30.4	16.5	30.6	30.9	31.9	58.8	17.1
a	42.5	44.5	39.9	51.4	21.4	62.1	62.3	69.6	47.6	55.7	29.1	29.2	33.8	63.8
u	23.9	44.5	0.0	0.0	22.6	13.6	13.6	0.0	35.8	13.8	4.2	32.4	6.8	19.0
d	0.0	0.0	0.0	0.0	12.3	0.0	0.0	0.0	0.0	0.0	18.1	6.4	0.6	0.0
sd	0.0	0.0	0.0	0.0	21.1	0.0	0.0	0.0	0.0	0.0	17.7	0.0	0.0	0.0

Figure 2: Summary Statistics and Graphs are used to Present the Credit Risk Properties

From Table 3, Standard deviation results range between 0.42-0.48. This falls within the bracket of ≤1.25 which is acceptable. From our 5-point Likert scale the average value /mean of the operational risks data set ranges between 3.2- 4.7. At $|t| \geq 1.96$ the overall t value for the independent values indicates a strong impact of the predicting quality of the coefficient. The overall p-value at less than 0.05 (typically ≤ 0.05) is statistically significant. For the Adjusted R square findings showed that Operational risks explain the variations in water sanitation investments while the difference is explained in other factors not in the model. According to Cohen (1988, 1992), the effect size is weak/low if the value of r varies around 0.1, Moderate/medium if r varies around 0.3, and strong/large if r varies more than 0.5. Model risk makes the strongest unique contribution explaining infrastructure investments followed by political risk, people risk and legal risk making the least contribution.

Table3: Contribution of Operational Risks

Variable/ Risk	Std. Dev.	Mean	t Stat	P/Sig F	Adj. R^2	Beta	Corr. analysis
X_1 –Operational	0.01	4.21	3.34	0.00	0.38	0.57	0.31
Sub-var.	**Std. Dev.**	**Mean**	**t Stat**	**P/Sig F**	**Adj. R^2**	**Beta**	**Corr. analysis**
Model	0.42-0.45	3.2- 4.7	6.85	0.00	0.30	0.66	0.56
People	0.45-0.48	3.2- 4.3	0.91	0.36	0.00	0.08	0.09
Legal	0.42-0.46	4.2- 4.7	-0.29	0.78	-0.01	-0.18	-0.03
Political	0.45-0.47	4.2- 4.6	0.62	0.54	-0.01	0.28	0.06

In Table 4, Standard deviation results range between 0.42-0.48. This falls within the bracket of ≤1.25 which is acceptable. From our 5-point Likert scale the average value of the credit risks data set ranges between 1.36- 4.67. At $|t|\geq 1.96$ the overall t value for the independent values indicates a strong impact of the predicting quality of the coefficient. The Overall p-value at less than 0.05 (typically ≤ 0.05) is statistically significant. For Adjusted R square findings showed that Credit risks explain the variations in water sanitation investments while the difference is explained in other factors not in the model. According to Cohen (1988, 1992), the effect size is weak/low if the value of r varies around 0.1, Moderate/medium if r varies around 0.3, and strong/large if r varies more than 0.5. Settlement risk makes the strongest unique contribution explaining infrastructure investments followed by exposure rate risk, sovereign risk and Recovery rate risk making the least contribution.

Table 4: Contribution of Credit Risks

Variable	Std. Dev.	Mean	t Stat	P / Sig F	Adj. R^2	Beta	Corr. analysis
X_2 -Credit risk	0.017	3.91	4.16	0.00	0.13	0.42	0.38
Sub-Variable	**Std. Dev.**	**Mean**	**t Stat**	**P / Sig F**	**Adj. R^2**	**Beta**	**Corr. analysis**
Exposure Rate risk	0.46-0.48	1.36- 4.67	3.86	0.00	0.12	0.18	0.35
Recovery Rate risk	0.42-0.47	3.32- 4.33	1.23	0.22	0.00	-0.09	0.12
Sovereign risk	0.45-0.46	3.32- 4.32	3.12	0.00	0.08	0.12	0.29
Settlement risk	0.45-0.47	4.28- 4.33	3.12	0.00	0.08	0.22	0.29

Table 5 indicate that, Standard deviation results range between 0.45-0.49. This falls within the bracket of ≤1.25 which is acceptable. From our 5-point Likert scale the average value of the operational risks data set ranges between 3.2- 4.6. At $|t|\geq 1.96$ the overall t value for the independent values indicates a strong impact of the predicting quality of the coefficient. The Funding liquidity and Asset liquidity risk p-value at less than 0.05 (typically ≤ 0.05) is statistically significant. For Adjusted R square findings showed that Liquidity risks explain the variations in water sanitation infrastructure investments while the difference is explained in other factors not in the model. According to Cohen (1988, 1992), the effect size is weak/low if the value of r varies around 0.1, moderate/medium if r varies around 0.3, and strong/large if r varies more than 0.5. Funding liquidity risk makes the strongest unique contribution explaining infrastructure investments and Asset liquidity risk making the least contribution

Table 5: Contribution of Liquidity Risks

Variable	Std. Dev.	Mean	t Stat	P / Sig F	Adj. R^2	Beta	Corr. analysis
X_3 - Liquidity risk	0.01407 is Acceptable	3.99	-0.39	0.70	-0.01	-0.05	-0.04
Sub-Variable	**Std. Dev.**	**Mean**	**t Stat**	**P / Sig F**	**Adj. R^2**	**Beta**	**Corr. analysis**
Asset Liquidity	Ranges between 0.45-0.47 which is acceptable	Ranges between 3.2- 4.3	-2.38	0.0192 Statistically is highly significant.	0.04	-0.10	-0.2272
Funding Liquidity	Ranges between 0.45-0.49 which is acceptable	Ranges between 3.3- 4.6	2.67 Indicates a strong influence	0.008735 statistically is highly significant.	0.06	0.17	0.25 significant positive relationship

Table 6 shows Standard deviation results range between 0.46-0.80. This falls within the bracket of≤1.25 which is acceptable. From our 5-point Likert scale the average value of the operational risks data set ranges between 1.46- 4.67. At $|t|\geq 1.96$ the overall t value for the independent values indicates a strong impact of the predicting quality of the coefficient. The overall p-value at less than 0.05 (typically ≤ 0.05) is statistically significant. In terms of Adjusted R square, the results show that environmental risks explain the variations in water sanitation investments while the difference is explained in other factors not in the model. According to Cohen (1988, 1992), the effect size is weak/low if the value of r varies around 0.1, Moderate/medium if r varies around 0.3, and strong/large if r varies more than 0.5. Catchment degradation risk makes the strongest unique contribution explaining infrastructure investments followed by sediment discharge risk, climate change risk and Effluent discharge risk making the least contribution

Table 6: Contribution of Environmental Risks

Variable	Std. Dev.	Mean	t Stat	P / Sig F	Adj. R^2	Beta	Corr. analysis
X_4 -Environmental risk	0.01	3.95	-3.72	0.00	0.11	-0.51	-0.34
Variable	**Std. Dev.**	**Mean**	**t Stat**	**P / Sig F**	**Adj. R^2**	**Beta**	**Corr. analysis**
Sediment Discharge	0.46-0.66	1.46- 4.63	-1.11	0.27	0.00	-0.04	0.11
Effluent Discharge	0.46-0.59	2.86- 4.67	-2.65	0.01	0.05	-0.22	-0.25
Climate Change	0.47-0.81	4.51- 4.67	-4.06	0.00	0.13	-0.22	-0.37
Catchment Degradation	0.57-0.63	3.9- 4.0	0.61	0.54	-0.01	0.04	0.06

Discussion

Risk of loss resulting from inadequate or failed internal processes, people, systems and external events have negatively affected investments. Concurs with Michalski (2009) the enterprise value maximization strategy is executed with a focus on risk and uncertainty. Coleman (2011) highlights that the finance industry is still searching for the best practice. This is driving efforts at finding robust processes for operational risk, and evaluating methodologies.

Change in the capital structure of the firm which dictates how funds are sourced for infrastructure projects greatly influences stakeholder's decisions. Accords with Canuto, Dos

Santos & de Sá Porto (2012) on investigating Sovereign risk and the role of credit rating agencies, there is indeed a strong correlation between a country's ratings and the level of macroeconomic variables, and between a country's ratings and the variation in levels of government debt.

Firms unable to meet their cash and collateral obligations threaten their financial position and going concern. Consents with Boyle & Guthrie (2003) The threat of future funding shortfalls lowers the value of the firm's timing options and encourages acceleration of investment beyond the first-best optimal level. Amihud & Mendelson (1986) in their Analysis of investment and portfolio management sees risk implications.

Threats of adverse effects on the environment by effluents, emissions, wastes, resource depletion, climate change influence water and sanitation projects. Goes along with Zouboulis & Tolkou (2015) findings that climate change has a dual effect on wastewater treatment (WWT) plants. The processes occurring in a wastewater treatment plant (WWTP) are subsequently affected by climate change. Issaka & Ashraf (2017) erosion causes both on-site and off-site effects on land and also on water bodies thereby affecting its quality.

Conclusion

Based on investigations to ascertain the combined influence of Operational risks, Credit risks, Liquidity risks and Environmental risks on water-sanitation infrastructure investments in Kenya test results on return on investments testify a significant influence on the returns expected from investments in water-sanitation infrastructure. Test results indicate a significant influence to the benefits expected from investments related to water-sanitation infrastructure. Financing investment projects as was noted above is an area exposed to a wide range of risks. Some of these risks are associated to investors (sponsors). The project is however, usually a standalone one, individualized and isolated from other assets of the investors who initiated it, so it should be judged only by its ability to be able to generate support and cash. On the other hand, infrastructure projects have a large social impact and entail risks associated with public sector and its actions.

With significant influence investment projects face substantial risks hence consequences on operations. The Modern Portfolio Theory (MPT) allows investors to assemble an asset portfolio that maximizes expected return for a given level of risk. Water and sanitation Infrastructure investments options to make decisions on include: Build – Operate – Transfer (BOT), Build – Own – Operate (BOO), Build – Own – Operate – Transfer (BOOT), Design – Build – Finance (DBF), Design – Build – Finance – Operate (DBFO), Design – Construct – Maintain – Finance (DCMF).

Examination from combined influence of Operational risk, Credit risk, Liquidity risk and Environmental risk on Infrastructure Investments in Water and Sanitation connote a significant positive relationship. Based on the findings, an advancement concerning the combined influence of Operational risks, Credit risks, Liquidity risks and Environmental risks key stakeholders within the infrastructure investments project life cycle need to establish an integrated ERM (Enterprise Risk Management) approach. This involves identifying and addressing methodically the potential events that represent risks to the achievement of strategic objectives, or to opportunities to gain competitive advantage.

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