African Tax and Customs Review
Issue 2, January – March 2019
atcr.kra.go.ke
ATCR is a Publication of the Kenya School of Revenue Administration, KRA

A Uniform Model for Conducting Cost Benefit Analysis for KRA Projects

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Abstract

The objectives of this study were three-fold. First, the study sought to design a scientific cost benefit analysis model to evaluate KRA project proposals before they are submitted to the National Treasury for possible funding. The second objective was to come up with streams of costs and benefits for the Authority's sampled projects over their useful lifespan. The third objective was to use the cost benefit analysis model to evaluate future KRA project proposals. The literature reviewed showed that in earlier years, cost benefit analysis was mainly applicable to government infrastructure projects in the fields of transport, urban settlement, health, education, defence and research and development. It further gained widespread application in the field of welfare economics where economic choice decisions had to be undertaken. This study therefore developed a cost benefit analysis model to evaluate KRA projects. The main input into the model was quantifying efficiency gains from the six sampled projects. The data on the sampled projects were collected from the KRA data base. The standard procedures of cost benefit analysis were then applied to the sampled projects. The results of the post ante cost benefit analysis show that the decision to invest in the projects was viable. This is because the projects yielded a positive net present value. A return on investment measure of project viability was applied to the sampled projects. The measure which is expressed as a benefit-cost ratio was 5.6 meaning that the expected benefits were over five times the expected costs of projects hence the projects were viable. Though it is not documented whether KRA applies the cost benefit analysis to its investment decisions, it is recommended that going forward, the Authority's investment decisions should be informed by the results of an appropriate cost benefit analysis model. It is therefore recommended that all future KRA projects should be subjected to a cost benefit analysis to evaluate their feasibility before they are approved for implementation. Secondly, a comprehensive process of quantifying project costs and benefits should be undertaken to make cost benefit analysis meaningful. Benefits should not only comprise of expected revenue generation but also expected efficiency gains resulting from projects under analysis. KRA should therefore adopt a uniform cost benefit model that seeks to utilise all quantifiable costs and benefits over a project's useful lifespan. Finally, since KRA operates under a tight budget constraint, sensitivity analysis should be undertaken to get the appropriate set of projects that yield highest net benefits and guarantee the best value for money and thus assist in arriving at the correct project mix.

Keywords: Cost Benefit Analysis, Project Feasibility

1.0 Introduction

Many governments across the world have adopted cost benefit analysis to guide their investment decisions. This is based on the fact that resources are limited and hence the need to channel investment resources in projects that guarantee high returns. Cost benefit analysis can therefore be used to guide a decision choice between various competing investment needs.

Whereas it is not clear whether the government of Kenya uses the cost benefit analysis in prioritising investment decisions, the Kenya Revenue Authority is committed to using a scientific model of cost benefit analysis in its investment decisions. The Authority's development projects proposals would therefore get strong support at the National Treasury for funding if they have well stated costs and benefits computed through a rigorous and scientific method.

It is noted that in the past, designers of development projects were only concerned with project costs without showing streams of benefits that the project would generate.

1.1 Objectives of the study

The main objective of this study is to come up with a scientific model for cost benefit analysis which would be applied to the authority's projects. The specific objectives include:

i) To design a scientific cost benefit analysis model applicable to the Authority's projects,

ii) To come up with practical streams of costs and benefits for the Authority's projects, and

iii) To use the scientific cost benefit analysis model developed in (i) above to evaluate future KRA development project proposals.

1.2 Statement of the Problem

The Authority has been spending a huge amount of resources on various capital projects since its inception. Whereas the projects have propelled the Authority to improve on its mandate with regard to service delivery, it is not clear whether benefits derived from such projects exceed costs and whether projects undertaken provided higher expected returns compared to other competing alternatives.

This study therefore seeks to provide answers to the following questions.

i) What would best inform the Authority's decision to invest in future projects?

ii) What are expected costs and benefits of the projects that the authority has invested in?

iii) Does the Authority get value for money in investing in such projects?

2.0 Literature Review

2.1 Definition of Cost Benefit Analysis

Cost benefit analysis which is sometimes referred to as benefit cost analysis is a systematic process for calculating and comparing benefits and costs of a project, decision or government policy. The purposes of cost benefit analysis are two-fold, namely: determining the soundness of an investment or decision (justification or feasibility) and providing a basis for projects comparison. The former is about justification or feasibility of the investment or decision while the later shows whether total expected benefits outweigh total expected costs and by how much.

Cost benefit analysis is a very comprehensive and theoretically sound method of economic evaluation of development projects (Robinson 1993). It has been instrumental in aiding decision-making process in the fields of economic and social policy in the public sector for the past seven decades.

Cost benefit analysis aims at placing a monetary value on both costs and benefits of a project so that its returns on investment can be compared with those from other projects. Where it is not easy to place monetary values to costs and benefits, other measures such as cost effectiveness and cost-utility analysis have been used especially in the health care sector.

According to the Canadian benefit cost analysis guide, revenue raised through taxes should be invested in projects and programmes which will do the most good given the available choices (Treasury Board of Canada Secretariat 1998). Cost benefit analysis therefore has three basic parameters which are costs, benefits and choices. Given resource constraints, it is important to ensure that resources are invested in projects that yield the highest possible net benefits per shilling invested.

Prest and Turvey (1965) defines cost benefit analysis as a practical way of assessing the desirability of projects in terms of their useful life and their impact on people, industries and regions. Cost benefit analysis involves specifying and evaluating all the relevant costs and benefits.

2.2 History of Cost benefit Analysis

Quade (1971) discusses the history of cost benefit analysis. The study states that cost benefit analysis originated from economic theory, practical engineering and in the operational analysis of the Second World War.

The economic theory of cost benefit analysis in government investment decisions dates back to the nineteenth century with works pioneered by Jules Dupuit of France. Dupuit (1844) states that the economic benefits of bridges and roads to a community are likely to outweigh the revenues generated to the government through actual payments of tolls and taxes by the public. Marglin (1967) as reviewed by MacEwan (1967) is a treatise on the problem of cost benefit analysis in a mixed economy and introduces a systematic analysis of government investment alternatives. Further works on cost benefit analysis came up during the twentieth century by economists such as A. C. Pigou as cited by Quade (1971).

Prest and Turvey (1965) states that cost benefit analysis draws from various branches of economics such as welfare economics, public finance and resource economics to bring into place a coherent subject for evaluating projects. The study contends that although interest in cost benefit analysis started in recent years, the subject has a long history dating back to 1844 when in France Dupit's classic paper on the utility of public works was published. Cost benefit analysis later gained prominence in the USA over the period 1902 to 1940s when it was adapted and used by the federal government as an administrative device not based on economic theory to improve navigation.

Interests among economists in cost benefit analysis grew tremendously over the period 1950 to 1963. According to Prest and Turvey (1965), the main reason for the increased interest was the growth of large investment projects that absorbed huge resources, had repercussions over a long period of time and substantially affected prices and outputs of other products. The other reason was the growth of the public sector with fast expanding public enterprises especially in the United Kingdom where nationalised industries accounted for 45% of gross fixed investment in 1963 compared to 33% in 1938. The other reason for the growing interest in the subject was the rapid development of other techniques such as operations research and systems analysis in both public and private sectors of the economy.

According to Pearce *et al* (2006), the theory of cost benefit analysis dates back to the issues of infrastructure appraisals in France in the 19th century. Further developments to the theory took place in the late 19th century and in 1920, economics of welfare by Pigou brought up the divergence between private and social cost. The new welfare economics of the late 1930s formed on the basis of ordinal utility theory was essentially cost benefit analysis as it began focusing on the costs and benefits of public investment decisions.

In the 1930s the divide between theory and practice of cost benefit analysis was bridged when the USA formally made it as a requirement to carry out the cost benefit analysis in water-related investment projects. Practical application of cost benefit analysis dates back to the twentieth century when the government of the United States of America started to improve harbour and river navigation. This was basically an administrative device under the River and Harbour Act of 1902 which required a board of engineers to evaluate the desirability of river and harbour project proposals by the Army Corps of Engineers. The evaluation was with regard to costs and commercial benefits.

The Flood Control Act of 1936 further stated that the USA government would only be involved in flood control projects if the benefits would exceed the estimated costs. This therefore provided more credence to cost benefit analysis from a practical engineering perspective.

Cost benefit analysis developed from a third perspective of operational analysis soon after the Second World War when the operational analysis of wartime developed into operations research and systems analysis. However, this was limited to cost effectiveness as military development and procurement decisions focused on which alternative was best rather than whether the task being considered was worth undertaking (Quade 1971).

It was not until 1965 that the United States Government cascaded the use of cost benefit analysis throughout the federal government after it was successfully implemented at the Department of Defence. This marked a major improvement from the application of the cost effectiveness to the comparison of costs and benefits to guide decision-making on government programmes before their budgets could be approved.

Since the 1960s, cost benefit analysis has been recognised as a fundamental appraisal technique for public investment and public policy (Pearce *et al* 2006).

2.3 Theoretical Literature

The theoretical foundation of cost benefit analysis is costs and benefits. According to Pearce *et al* (2006), benefits are increases in utility (human wellbeing) and costs are reductions in utility. A project or policy therefore qualifies under cost benefit analysis if its social benefits exceed social costs within a particular jurisdiction usually a nation.

In cost benefit analysis there are two rules of aggregation. The first one is aggregation of all benefits across different social groups. This could be done by summing up willingness to pay or willingness to accept compensation for losses regardless of the circumstances of the beneficiaries and losers. The second aggregation rule involves assigning greater weights to benefits or costs accruing to disadvantaged or low-income groups. This is based on the rationale that disadvantaged groups will have a higher marginal utility of income compared to high income groups. Aggregation of benefits and cost will normally be done over time since benefits and costs accrue at different points in time. This therefore brings in the concept of time discounting leading to the concept of time value for money which is basically present values. Inflation can overstate future benefits and costs and hence it needs to be netted out and thereby securing a constant price estimate of benefits and costs. Cost benefit analysis is also hinged on the common unit of measurement. Hence both benefits and costs should be measured in a single currency.

2.4 Limitations of cost benefit analysis

The application of cost benefit analysis is mainly in welfare economics yet is has been criticised on various grounds. Pearce *et al* (2006) highlights the following criticisms.

The main criticism is on the robustness of the theoretical foundations of the concept. The results of the Kaldor-Hicks compensation test in welfare economics put to question the robustness of the foundations. According to the test, people that are made better off by a project should compensate those that are made worse off by the project in order to achieve pareto efficiency. However, in practice project beneficiaries do not compensate project losers. This therefore means that a more efficient outcome can actually leave some people worse off.

The second criticism of cost benefit analysis is on the underlying social welfare function. It is an arbitrarily large number of such functions on which consensus is unlikely to be achieved.

The third criticism is that cost benefit analysis can allow an individual's preferences be the main determining factor in guiding social decision rules hence making it unethical.

The forth criticism is that the neoclassical welfare economics has focused debate on the extent to which the notion of economic efficiency underlying the Kaldor-Hicks compensation test can or should be separated out from the issue of the distributional incidence of benefits and costs (who gains and who loses).

Debate continues around the first and second criticisms whereas the third criticism reflects the democratic presumption in cost benefit analysis that individual preferences are important. The last criticism has been countered on the strength that cost benefit analysis has developed procedures for dealing with the economic efficiency such as the use of distributional weights and stakeholder involvement.

Prest and Turvey (1965) cites two limitations of cost benefit analysis. The first one is that techniques of cost benefit analysis apply within a framework that is determined in advance and involves a wide range of considerations including political as well as social characteristics. The second one is that cost benefit analysis as so far developed would not be quite relevant and usable for decision making on very large investments. Decision techniques for such large-sized investments would be general equilibrium approach instead of cost benefit analysis. Although the second limitation implies that cost benefit analysis might not be appropriate for application in developing countries, Prest and Turvey (1965) states that this should not be a rule and each investment project should be considered independently and further that developing countries have a shortage of capital resources and hence the above rule does not apply. In conclusion, the debate enlightens one to be aware of the limitations of the technique to be used in each particular case.

The use of cost benefit analysis is strengthened if its limitations are recognised and emphasised. It would therefore not add value in evaluating a large project, a project whose benefits are widely diffused, and in which there are manifest divergences between accounting and economic costs or benefits. In addition, it is not realistic to expect comparisons between projects in entirely different branches of economic activity as those between projects in the same branch. Cost benefit analysis is more useful in the field of public utility than in the areas of social services. Finally cost benefit analysis is more useful in making comparisons on projects in the same field than in different fields. For example, it is easier to compare road project than road and water projects. Alternatively, it would be helpful to apply cost benefit analysis on projects in the fields of road and water than to those in the fields of health, education or research and development.

2.5 Empirical Review

Cost benefit analysis has been applied in various fields where economic choices had to be made. According to Prest and Turvey (1965), investment projects and decisions are among the areas where cost benefit analysis has been applied. Cost benefit analysis can also be applied to proposed changes in laws or regulations. The guiding principle for the application of cost benefit analysis is the need for decision makers to maximise the present value of all benefits less that of all costs, subject to specified constraints.

Cost benefit analysis has been applied in investment projects and decisions in the fields of water projects (e.g., irrigation, flood control and hydroelectric schemes) and transport (roads, railways, inland waterways), land usage schemes (urban renewal, recreation and land reclamation), health, education, research and development, and defence (Prest and Turvey 1965).

Kidd and Crandall (2006) review the establishment of revenue authorities across the world from the mid-1980s and conclude that most of them were established based on literature review and perceived advantages without conducting a cost benefit analysis. The study notes close to 40 revenue authorities had been established across the world with majority in Africa and Latin America based on the need for reforms promoted by both governments and international organisations. Further, the study notes that attempts at conducting ex post cost benefit analysis of the revenue authorities' governance model have been hampered by lack of appropriate data attributable to the revenue authority. There is only anecdotal evidence to support the performance of revenue authority as attributable to autonomy and in instances where some data exist, they measure the progress of reforms but not justification of the establishment of the revenue authority.

2.6 Summary of the literature

The literature reviewed shows that cost benefit analysis which is also referred to as benefit cost analysis is a systematic process of calculating and comparing benefits and costs of a project, decision or government policy. It started way back in the nineteenth century in France and later in the United States of America, Canada and the United Kingdom. Its development and adoption gained impetus after the Second World War and became a formal tool of analysis in the USA in the 1960s. Cost benefit Analysis grew from three sources namely economic theory, practical engineering and operational analysis. The economic theory source is hinged upon the utility theory for maximisation of benefits and minimisation of cost which is the basis for welfare economics.

Cost benefit analysis has clear procedures that summation of weighted benefits across different social groups, time discounting that brings into the analysis the concept of time value for money (present value), netting out inflationary effects and use of a common unit of measure to quantify benefits and costs in monetary terms.

Despite the fact that cost benefit analysis has been criticised along the Kaldor-Hicks compensation tests, underlying social welfare function, individual's preferences and distributional incidence of benefits and costs, it still remains a robust and well ground analytical tool that is used to evaluate feasibility of investment decisions and choice of programmes. Cost befit analysis can be used either ex ante or post ante. It has been applied in investment decision in water projects, transport, land use schemes, health, education, defence and research and development.

3.0 Methodology

The study utilised standard procedures on data on costs and benefits streams of KRA projects to assess whether stated objectives were achieved.

3.1 Theoretical model

Cost benefit analysis is a systematic and rational decision-making process where costs and benefits from a particular project are analysed and compared to net benefits from alternative projects. Cost benefit analysis is a technique involving the following steps: identification of alternatives; defining alternatives in a manner that allows comparison; adjusting for the streams of costs and benefits over time; calculating monetary value of all benefits and costs; coping with uncertainty in data; and summing up a complex pattern of costs and benefits to guide decision making.

Cost benefit analysis provides a framework under which all costs and benefits are quantified in a monetary measure and analysed. Another related concept is cost effectiveness which is used where some of the costs or benefits cannot be quantified in monetary terms. Cost effectiveness therefore aims at making a decision where a goal would be achieved at the most minimal cost strategy for a case where benefits are not quantifiable in monetary terms.

According to the Canadian Benefit Cost Analysis Guide, there are particular steps that need to be followed in carrying out a cost benefit analysis. The steps are enumerated below:

i) Examine the needs, constraints and formulate objectives and targets of the benefit cost analysis

ii) Define options which the analysis can provide comparisons

iii) Carry out an analysis of the incremental effects and collect data on cost and benefits

iv) Express the costs and benefits in a uniform standard measure such as converting values from nominal to real terms

v) Run a deterministic model to get the net present value.

vi) Conduct a sensitivity analysis to identify variables that have a greater influence on net present value

vii) Analyse risks using the ranges and probabilities of the costs and benefits values and by simulating expected outcomes of the investment

viii) Identify options that provide desirable distribution of income

ix) Consider all the quantitative analysis as well as qualitative analysis of non-quantifiable factors and make appropriate recommendations.

According to Prest and Turvey (1965), answers to the following four questions constitute the general principles of cost benefit analysis: (a) Which costs and which benefits are to be included? (b) How are they to be valued? (c) At what interest rate are they to be discounted? (d) What are the relevant constraints?

According to Pearce *et al* (2006), conducting cost benefit analysis follows a certain logical sequence of steps. The first step is to know the problem being addressed or the issue under consideration and what options are available. Cost benefit analysis usually has a goal which should guide the process. Consider different feasible ways of achieving that goal and the timeframe of the project/policy.

The second step is to assess whether the project/policy under consideration should be undertaken. Cost benefit analysis applies to both policies and projects (investments) either ex ante or ex post. Use of cost benefit analysis in the ex-ante context helps to make a decision on whether funds should be invested in the project/policy or not. The answer would be positive if the present value of expected benefits is greater than the present value of expected costs.

On the other hand, cost benefit analysis can be used ex post to find out whether it was worth investing in the existing project or policy. The rationale for the ex post cost benefit analysis is that although already resources committed into the project/policy are irreversible, it can shed light on the accuracy of the ex-ante cost benefit analysis that was conducted and whatever decision rule was used to justify the project/policy. It can also be used as a learning process to determine what does and what does not contribute to overall social wellbeing.

The third step is to consider the optimal scale of the project or policy to be undertaken. Using the example of a road, the decision would be whether the road should be two lanes or three lanes. The guiding principle is that the scale of the project/policy should be determined at a point where the marginal social benefits of the project/policy equal to the marginal costs of the project/policy.

In the case of competing projects/polices cost benefit analysis can be used to identify the best project (one with the highest net present value benefits). However, in a situation where there is only one project or policy, cost benefit analysis could be used to determine the value of money and even bring up other alternatives. Cost benefit analysis can be done to ensure that costs are minimised not only in the project/policy under consideration but also to inform future decisions regarding projects or policies whose alternative are limited by law so that value for money can be realised.

The fourth step is to carry out a sensitivity analysis. In this case, there could be projects which are mutually exclusive and hence easy to make a decision. However, some decision rules might require a mixture of projects to achieve the best value for money. This should still be guided by those combinations that yield the highest net benefits. Some projects might have different costs and hence the need to normalise them to make the projects comparable.

The fifth step is to decide when the project/policy should commence. It is not always prudent to start the project at a scheduled time. Special considerations should be taken into account especially if investment in the project is irreversible and hence more time is needed to learn more about the project. This is again done so as to maximise net social benefits.

The final step is to decide which projects/policies should be undertaken if they are not mutually exclusive and there is a budget constraint. The main point is to decide which projects should be implemented first and hence the need to rank them. In this regard, the decision rule would be to undertaken the projects not based on the net social benefits but on the benefit-cost ratios. Projects with higher benefit-cost ratios should be prioritised.

3.2 Empirical Model

This section explains the practical steps that were undertaken when conducting the cost benefit analysis on the Authority's projects.

The following model was used for computing the net present value of the projects.

$$NPV = (B - C) * D \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where: NPV is the net present value of the project,

B is the benefits,

C is the costs, and

D is the discount factor.

Equation (1) above therefore shows that the net present value of a project is equal to the discounted net benefits. The equation can be further expounded as shown below:

$$NPV = -C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_r}{(1+r)^T} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (2)$$

Where: C_0 is the initial investment,

C_i for i=1, 2, ... r is the net benefits in each fiscal year,

r is the discount rate, and

T is time in years.

Equation (2) above therefore shows that the net present value of a project is the summation of annual discounted net benefits of that particular project over its useful period less initial capital outlay.

A general formulation for the net present value model can then be presented as follows.

$$NPV = \sum_{t=0}^{n} \frac{(Benfits - Costs)_t}{(1+r)^t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (3)$$

Where: r is the discount rate,

t is year, and

n is the analytical horizon or the project's useful period in years.

The net present value is therefore a summation of the discounted net benefits over the useful period of the project.

Equation (3) above can therefore be used to determine the decision rule of the project. A positive net present value shows that the decision to invest in the project was feasible since the project is expected to yield higher returns compared to costs incurred over its useful period.

The summation of the net present values for all projects enables us to evaluate whether the decision to invest in that set of projects was feasible. An overall positive net present value for a set of projects shows that the decision to invest in that set of projects was feasible since collectively, the projects yield higher returns compared to cost. If the net present value is negative, then it means that the decision to invest in that set of projects was not feasible and would not have been undertaken since the costs exceed the returns generated by those projects.

This study therefore used equation (3) for selected projects in the Authority. This enabled us to make a decision on the feasibility of the investment in those particular projects. The summation of the net present values generated through equation (3) provided an assessment of the overall investment decision in the set of sampled projects.

3.2.1 Projects identification

The study used a sample of selected projects that had been undertaken in the Authority over the past six years. All capital projects that had been funded and undertaken over the past six years formed the sample for this study.

3.2.2 Costs and Benefits

The main task was to identify all costs and streams of benefits of all the projects over their useful period. In order to have a standardised assessment of the projects, the useful life of the projects was assumed to be ten years. It was further noted that there would be costs and benefits which were not readily quantifiable in monetary terms. The study strived to quantify all project costs and benefits to ensure a practical and objective assessment of the investment decisions.

3.2.3 Discount factor

A discounting factor for the costs and benefits was used to arrive at the projects' net present value. It is noted that costs and benefits of a project could accrue at different time periods. A discounting fact therefore provided a meaningful comparison of costs and benefits of a project which occurred at different periods. Discounting also made it meaningful to compare the net benefits of different investments.

The discounting factor was assumed to be equal to the interest rate on the government bond which is usually fixed at 12 percent per annum. The government bond is a long-term investment instrument and therefore becomes an appropriate proxy for the discount factor for investment projects. It therefore captures the opportunity cost of the investment.

3.2.4 Discounted net benefits

The application of the discount factor to benefits and costs enabled us to compute the discounted net benefits for each project. The discounted net benefits are also referred to as the net present value of the project. When computing the net present value, it was assumed that the costs and benefits of the projects were provided at constant prices and thus had netted out the fluctuations occasioned by inflation.

3.2.5 Decision Rule

According to the decision rule of the cost benefit analysis, an investment decision is viable if the project's net present value is equal to or greater than zero. Thus a project that yielded a positive net present value was passed as viable for investment. Viability of two or more projects could be assessed based on the net present value. If a decision was to be made regarding which project to invest in, then the project with the highest net present value would be most preferred. Those with a lower net present value, though basically generate a positive net return, would be left out. In this study however, sensitivity analysis that compares competing investment projects was done. Since the projects being studied had already been undertaken, the decision rule was not to find out which project provided maximum returns but to assess whether the decision to invest in such projects was sound.

An overall decision was made on the whole sample of projects reviewed to determine whether it was right to invest in them. This involved the summation of the net present value of all the projects. A positive net present value therefore implied that the decision to invest in the projects was right since they provided a positive return.

A benefit cost ratio was computed for each project and used to rank the projects based on their value of the returns per shilling invested in the project.

3.3 Application to future projects

The study reviewed the investment decisions of already implemented projects at the Authority. Though the decision to invest in such projects was irreversible, the lessons learnt would be beneficial to the Authority's decisions on future investments. The results of the study would also provide a framework upon which future potential investment projects would be assessed for their viability. Going forward therefore, all potential investment projects would be subjected to the cost benefit analysis before a decision was made. Since the Authority operates under a budget constraint, a sensitivity analysis would be conducted on future projects to ensure that funds were invested in projects that provided the highest net returns and thus ensured value for money.

3.4 Data sources

The data which were used in this study were collected from the KRA databases. An inventory of the projects undertaken in the past six years was prepared and a sample taken for analysis. The data comprised the initial capital investment in each project, recurrent costs and annual quantifiable benefits accruing from each project over its useful life. Benefits therefore comprised expected revenue collection and efficiency gains while costs included the initial capital outlay and recurrent costs for each sampled project.

The discount rate used for all projects was the long-term government infrastructure bond rate of 12 percent per annum. This rate was chosen because it provides a better measure of the opportunity cost of investing government funds in alternative projects. The rate is also stable over a long-term period.

Table 1 below provides a sample framework for the cost benefit analysis that was used for the sampled projects as explained above.

Table 1: A template for cost benefit analysis of sampled projects

Project 1					
	Benefit	Cost	Net Benefit	Discount Factor*	Discounted net benefits
Year 1					
Year 2					
Year 3					
Year 4					
Year 5					
Year 6					
Year 7					
Year 8					
Year 9					
Year 10					
Net Present Value					
* Assumes a discount rate of 12%.					

4.0 Results Analysis

The study was expected to come up with a uniform cost benefit analysis model which would be consistently applied to all projects in the Authority. The model therefore shows clearly the costs and stream of benefits for each project over the project's life span. The costs and stream of benefits were computed in terms of revenue collection, efficiency gains and taxpayer compliance benefits for each proposed project.

A post ante cost benefit analysis was undertaken on the following six projects and a summary of results is shown in Table 2 below:

i). Integrated Enterprise Solution (IES),

ii). Cargo Scanners,

iii). iTax /Legacy transition,

iv). Real Estate,

v). Kenya School of Revenue Administration (KESRA) Modernization, and

vi). Rehabilitation of border stations.

Table 2: A summary of post ante cost benefit analysis results for selected projects (Figures in Kshs million)

Project	Costs	Benefits	Net Benefit	Revenue/ Costs	Efficiency /Costs	Return on Investment (B/C Ratio	Net Present Value*
Integrated Enterprise Solution	4,642	19,807	15,165	0.2	4.0	4.3	5,364
Rehabilitation of Border Stations	3,393	-	-3,393	-	-	-	-2,762
Modernization of KESRA	2,527	3,961	1,433	-	1.6	1.6	376
Cargo Scanning - I	9,418	8,665	-753	0.9	-	0.9	-1,655
Cargo Scanning - II	5,146	8,665	3,519	1.7	-	1.7	1,277
Transition from Legacy to iTax	490	-	-490	-	-	-	0
Real Estate	300	103,623	103,323	345.4	-	345.4	54,701
Grand Total	25,916	144,722	118,806	4.7	0.9	5.6	57,301
* Assumes a discount rate of 12% per annum.							

4.1 Feasibility of investment decisions in KRA Projects

4.1.1 Projects Net Present Value

The results are for key projects implemented in the past three years and their expected costs and benefits discounted over a ten-year period starting from 2014/15 to 2024/25 at the discount rate of 12 percent per annum. On the overall the projects have an expected net present value of Kshs 57.3

billion. This means that the decision to invest in the projects was feasible since they have expected positive net benefits over their useful life.

4.1.2 Return on Investment

The return on investment which is measured by dividing expected total benefits by expected total cost is 5.6. The return on investment is positive and greater than one meaning that the investment decision was feasible. It also means that expected total benefits are five times more than costs hence the investments in the projects was viable.

4.1.3 Revenue-Cost Ratio

Another measure of projects visibility is the revenue-cost ratio which is 4.7. This means the decision to invest in the selected projects was viable since the projects' expected revenues are four times more than expected costs.

4.1.4 Efficiency-Cost Ratio

The last feasibility measure is the efficiency-cost ratio which is 0.9. This shows that the projects fail the feasibility measure on efficiency grounds in that the expected efficiency gains are lower than the expected projects costs. However, this measure could not be used to reject the feasibility of the investment decision since efficiency gain was just one component of the expected total benefits to be derived from the projects.

4.2 Uniform model for Cost Benefit Analysis for KRA Projects

The above post ante cost benefit analysis on selected KRA projects utilised the concept of net present value to evaluate the feasibility of the investment decision. The costs included both initial capital outlays and recurrent project costs while benefits comprised of both revenue and efficiency gains realised from those projects. The expected net benefits were discounted using the long-term National Treasury bond rate of 12 percent per annum.

Two main measures of feasibility were applied to the selected projects. These are the net present value and the return on investment ratio.

The inclusion of all costs and benefits into the cost benefit analysis model captured the true position of the KRA projects. It is noted that the projects not only aimed at enhancing revenue collection but also cost reduction to both the Authority and taxpayers hence providing efficiency in service delivery. Inclusion of efficiency gains in the analysis was therefore an important step in making the model more useful to the Authority's business.

The concept of a uniform model as used in this study therefore provides that all projects should contain a comprehensive stream of quantifiable benefits both revenue and non-revenue (efficiency gains).

5.0 Conclusion and Policy Recommendations

5.1 Conclusion

The objectives of this study were three-fold. First, the study sought to design a scientific cost benefit analysis model that could be applied to the KRA projects. The model is aimed at assisting the Authority evaluate its project proposals before they are submitted to the National Treasury for possible funding.

The second objective was to come up with streams of costs and benefits for the Authority's sampled projects. This involved identifying specific costs and categories of quantifiable benefits to be used in the cost benefit analysis model.

The third objective was to use the scientific cost benefit analysis model to evaluate future KRA project proposals.

The study reviewed the relevant theoretical and empirical literature in the field of cost benefit analysis. It is noted that cost benefit analysis started in the nineteenth century in France and spread to the USA, Canada and United Kingdom. It was mainly applicable to government infrastructure projects in the fields of transport, urban settlement, health, education, defence and research and development.

Three main areas explain the origin of cost benefit analysis namely economic theory, practical engineering and operational analysis. It is the branch of economic theory that further developed the cost benefit analysis to the present-day level. Its widespread application is in the field of welfare economics where economic choice decisions have to be undertaken.

Cost benefit analysis developed further after the Second World War and gained widespread applicability in government projects and programmes from the 1960s. Despite some criticisms and limitations of cost benefit analysis, its procedures of analysis are well rooted in the foundation of economic theory thereby making the results of analysis to be reliable for evaluating the feasibility of investment decisions as well as comparing expected net benefits from various projects.

A cost benefit analysis model was developed to evaluate KRA projects. The main input into the model was quantifying efficiency gains from the six sampled projects. The data on the sampled projects was collected from the KRA data base. The standard procedures of cost benefit analysis were then applied to the sampled projects. The results of the post ante cost benefit analysis show that the decision to invest in the project was viable. This is because the projects yielded a positive net present value. A return on investment measure of project viability was applied to the sampled projects. The measure which is expressed as a benefit-cost ratio was 5.6 meaning that the expected benefits were over five times the expected costs of projects hence the projects were viable.

5.2 Recommendations

Cost benefit analysis is very important in determining the viability of investment decisions. The application of cost benefit analysis to KRA's sampled projects showed that the decision to invest in those projects was viable. Though it is not documented whether KRA applies the cost benefit analysis to its investment decisions, it is recommended that the going forward, the Authority's investment decisions should be informed by the results of an appropriate cost benefit analysis model. It is therefore recommended that all future KRA projects should be subjected to a cost benefit analysis to evaluate their feasibility before they are approved for implementation.

The second recommendation from this study is that a comprehensive process of quantifying project costs and benefits should be undertaken to make cost benefit analysis meaningful. In this regard, benefits not only comprise of expected revenue generation but also expected efficiency gains resulting from projects under analysis. KRA should therefore adopt a uniform cost benefit model that seeks to utilise all quantifiable costs and benefits over a project's useful lifespan.

The final recommendation that since KRA operates under a tight budget constraint, sensitivity analysis should undertaken to get the appropriate set of projects that yield highest net benefits and guarantee the best value for money. Sensitivity analysis assists in arriving at the correct project mix.

5.3 Limitation of the Study and Areas for further Research

The results of this study are based on a limited choice of projects due to the practicality of getting available data. Data on some projects which would have been analysed were not readily available and/or were not accurate and hence could not be included in the analysis. This therefore could constrain the generalisation of the overall net present value attained in this study to qualify all KRA projects as feasible.

Secondly, sensitivity analysis was not done because the study undertook a post ante analysis. Future studies should therefore include ex ante cost benefit analysis for proposed projects and thereby undertake a sensitivity analysis to inform investment decisions.

References

Dupuit J. (1844), *On the Measurement of the Utility of Public Works*, English Translation in *International Economic Papers*, No.2, London, Macmillan, 1952

Kidd M. and W. Crandall (2006), Revenue Authorities: Issues and Problems in Evaluating Their Success, *International Monetary Fund*, Working Paper No. 06/240

MacEwan A. (1967), A Review of: Public Investment Criteria: Benefit-Cost Analysis for Planned Economic Growth by Stephen A. Marglin; Investments for Capacity Expansion: Size, Location and Time-Phasing by Alan S. Manne, *The Pakistan Development Review,* Vol. 7 No. 3

Pearce D., G. Atkinson and S. Mourato (2006), *Cost-Benefit Analysis and the Environment: Recent Developments*, Organisation for Economic Co-operation and Development, Paris.

Prest A. R. and R. Turvey (1965), Cost Benefit Analysis: A Survey, *The Economic Journal*, Vol. 75, No. 300, pp. 683-735

Quade E. S. (1971), A History of Cost-Effectiveness, *IFORS International Cost-Effectiveness Conference, April 12 – 15, 1971,* Washington, D.C.

Robinson R. (1993), Economic Evaluation and Health Care: Cost Benefit Analysis, *BMJ* Vol. 307, pp 924-6

Treasury Board of Canada Secretariat (1998), *Benefit-Cost Analysis Guide*, Ottawa.