UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

AUDIT RISK ASSESMENT FRAMEWORK USING BELIEF – FUNCTION MODEL FOR KENYA NATIONAL AUDIT OFFICE (KENAO).

BY

FRANCIS GICHURE.
P56/P/7063/06

Supervisor

Dr. PETER W. WAGACHA

JULY 2010

Submitted in partial fulfillment of the requirements for the award of Master of Science degree in Information Systems.

DECLARATION

This project as presented in this report is my original work and has not been presented for any other University Award.

Signed: .....

Name: **FRANCIS GICHURE**

Admission Number: **P56/P/7063/06**

Date: **22 July 2010**

The project has been submitted as part fulfillment of requirement for the Masters of Science in Information Systems of the University of Nairobi with my approval as the University supervisor.

Signed: .....

Name: **PETER WAIGANJO WAGACHA**

Date: 28/07/10

ACKNOWLEDGEMENT

I thank Almighty God for giving me good health and wisdom not to give up even when things stopped moving.

Special gratitude goes to my supervisor, Dr. Peter W. Wagacha for his continuous guidance throughout my proggramme especially during my project period. Also thanks to the University of Nairobi, School of Computing and Informatics' Management and Academic staff for all the support provided.

Special thank goes to the Kenya National Audit Office and in particular the Controller and Auditor General S. M. Gatumbu and the training Division for giving me a paper and a pen.

I owe a lot to all the colleagues of Kenya National Audit Office especially my immediate workmates from Forensic Audit who encouraged me to move on even when it was hard to do so. Special thanks go to Mr. John M. Karingithi for his wonderful support through out the course.

I appreciate the support from my dear wife Cecilia Wanjiku who inspired and prayed for me from the start to the end of the course. Thanks to my lovely children Annabell, Faith and Tony for laughing at me when I scored below 80% in my continuous assessment tests. You made me laugh too.

ABSTRACT

Program planning regarding the nature, extent, and timing of procedures is critical to audit efficiency and effectiveness. The prevailing paradigm in practice to accomplish this task is the Audit Risk Model. This model has been found to be deficient and outdated because it fails to incorporate the structure of audit evidence and also fails to represent uncertainties in audit evidence.

This article relates belief functions to the structure of audit risk and provides formulas for audit risk under certain simplifying assumptions. These formulas give plausibilities of error in the belief-function sense.

The belief-function plausibility represents auditors' intuitive understanding of audit risk better than ordinary probability. The plausibility of a statement, within belief-function theory, measures the extent to which we lack evidence against the statement. High plausibility for error indicates only a lack of assurance, not positive evidence that there is error. This high plausibility does not necessarily indicate any evidence that the statement is materially misstated, and hence it is inappropriate to interpret it as a probability of material misstatement.

Our findings indicate that the Belief-Function model accurately reflect the views of the auditor regarding the assurance obtained on the engagement in testing the accounts receivable area. Sensitively analyses revealed that the model can be used to assess the assurance provided by a given test or set of tests in attaining a cost-effective audits.

A working prototype has been implemented and tested indicating that belief – function model would result in cheaper audits, timely reports among other benefits. However, the model has some applicability limitations that require some improvements and more research.

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ABBREVIATIONS

AP/APR	Analytical Procedure
APRA	Analytical Procedure at Accounts level
APRF	Analytical Procedure at Financial Statement level
AR	Audit Risk
ARtAO	Total Audit risk at objective level
ARtA	Total Audit risk at Accounts level
ARtF	Total Audit risk at Financial Statement level
DR	Detection Risk
IRA	Inherent Risk at Accounts level
IRF	Inherent Risk at Financial Statement level
IR	Inherent Risk
IT	Information technology
KENAO	Kenya National Audit Office
RMM	Risk of Material Misstatement
SAI	Supreme Audit Institution
SAS	Statement of Auditing Standard
TD	Test of Details

1.0 INTRODUCTION

1.1 Auditing

1.1.1 Definition of Audit

By definition, audit is an independent assessment and evaluation of an institution's activities for a specific purpose.

1.1.2 Purpose of an audit

The purposes of these audits may be varied, but they all yield unique value to the auditee. Such purposes may include gaining an understanding of the area's operations, evaluating the adequacy of the control structure for potential key issues and areas of concern, providing on-going feedback to area management, validating and reviewing data for completeness, accuracy, and authorization, or assessing a data center for security, operations, application maintenance, and system implementations

1.1.3 Types of Audits

Operational Audit: Sometimes called program or performance audits, this type of audit examines the use of an organization's resources to evaluate whether those resources are being used in the most efficient and effective ways to fulfill the organization's mission and objectives. An operational audit may include elements of a compliance audit, a financial audit, and an information systems audit.

Financial Audit: A financial audit involves an evaluation of control processes which are designed to provide assurance to management that the financial statements are fairly stated.

Compliance Audit: The goal of this type of review is to determine whether an organization is maintaining a sound internal control environment that facilitates regulatory compliance.

Information Technology (IT) Audit: An IT audit assesses the security of an IT application and its hardware, software and network operating environment.

Loss and Fraud Investigations: The purpose of this audit is to provide evidence that is admissible in court of law

1.1.4 Audit Process

Figure 1: Steps in Audit Process

1.1.5 Components of an Audit

The **Risk Assessment** identifies relevant risk factors that challenge an organizational area and further considers their relative significance.

The **Scope Statement** identifies the activities that will be covered during the course of the audit. This would include the project justification, the project description, the deliverables, and the success criteria.

Audit Program is the document that contains the listing of audit procedures as well as the objectives of the audit.

Audit Procedures are the specific tasks that the auditor will follow to gather, analyze, and document during the audit.

Working papers are the detailed documentation from interviews and testing that were conducted to complete the audit program.

1.2 Simple Graphical representation of Financial Statements

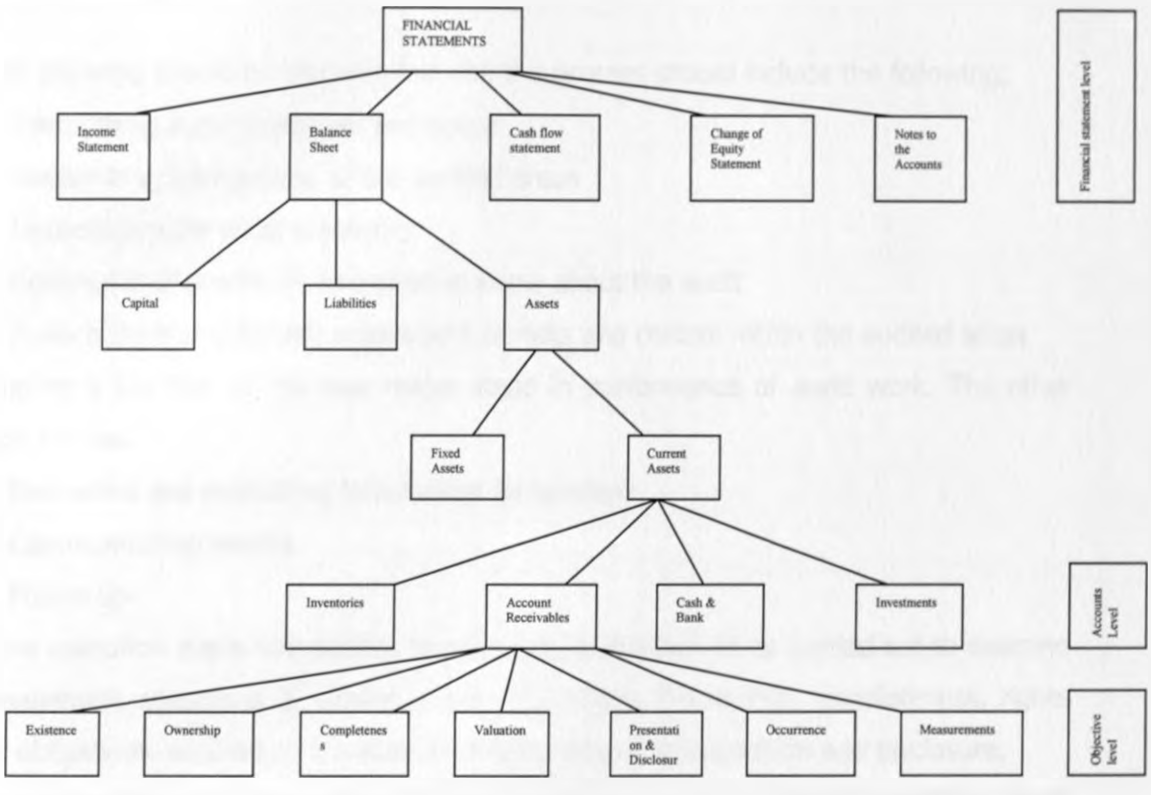

Figure 2: Components of Financial Statements

1.3 Audit Risk

1.3.1 Background Information

In recent years, there has been a significant level of activity in the artificial intelligence and expert systems area for audit decisions both by academics and practitioners.

Proper audit planning helps to ensure that auditors and management share the same agenda and that each engagement adds value to the client. New comers to the profession often do not fully understand the value of audit planning "why not just do it?" they ask, "why don't we just walk in the door and start ticking?" Unfortunately, no audit department has enough time or resources to do everything that could be done, which means that we must predetermine what is most important and what steps will be most likely to ensure success.

During the planning process, the auditor must ask management for their objectives and compare them to the audit scope to be sure that the audit work helps management to meet their objectives otherwise it will not generally produce information on which management will act.

Audit planning should be documented and the process should include the following;

- Establishing audit objectives and scope
- Researching background of the audited areas
- Determining the audit resources
- Communicating with all who need to know about the audit
- Performing a preliminary assessment of risks and control within the audited areas

Planning is the first of the four major steps in performance of audit work. The other steps include;

- Examining and evaluating information (execution)
- Communicating results
- Follow up

At the execution steps, the auditor pre-determines the task to be carried out to examine management assertions of existence and occurrence, Ownership, completeness, rights and obligations, accuracy and valuation, Measurement, presentation and disclosure.

The auditor will assess the audit risk based on the above management assertions. Audit risk is the risk that the auditor issues unqualified opinion when financial statements are materially misstated.

Financial Statements are materially misstated when they contain errors whose effects, individually or in the aggregate, causes them not to give a true and fair view.

Auditors need to assess the risk that errors may cause the Financial Statements to contain a material misstatement. Based on that assessment, an auditor will plan his audit and design his audit procedures to provide him with reasonable assurance of detecting errors that are material to the Financial Statements.

1.3.2 Nature of Audit Risk

Audit risk is the risk that the auditor may unknowingly fail to qualify his opinion on Financial Statements that are materially misstated. Auditors can reduce the level of risk associated with an audit engagement but cannot eliminate it altogether. There is always

some element of residual risk which has to be accepted. The extent of that acceptable risk is a matter of judgement. The key is to plan the audit so that this risk will be limited to what is, in his professional judgement, an appropriately low level.

1.3.3 Assessment of Audit Risk

In planning phase of the audit, a preliminary assessment should be made of the overall level of risk of misstatement in the Financial Statements to be audited. This overall risk assessment is made in addition to assessing audit risk at the account balance or class-of- transactions level.

It is based on the existing facts and circumstances regarding the engagement that have an impact on the risk of material misstatement. Such facts and circumstances relate to, among other things, the entity, its industry, its financial and operating characteristics, its management characteristics and the auditors experience in auditing the client in previous years. Many considerations are involved as detailed in **appendix C.** The auditor has been traditionally using the audit risk model to assess this risk.

All other things being equal, a higher overall audit risk assessment would cause the auditor for example to;

- Assign more experienced staff to the engagement
- Increase the supervision of staff
- Apply the audit procedures closer to year- end
- Apply additional quality control procedures such as the appointment of an additional member to the audit team

1.3.4 Audit Risk Model

The audit risk model for financial statement audits

The audit risk model has provided a conceptual framework for auditing practice for more than 40 years. The model has been fairly effective in helping auditors analyze risks and use that analysis to determine the nature, timing and extent of audit procedures (especially substantive procedures) in audits of financial statements.

Even though audit risk may be viewed as applying to the financial statements taken as a whole, the auditor is required to evaluate audit risk at the relevant assertion level. Thus, the auditor applies the audit risk model at the relevant assertion level. The primary purpose of the audit risk model is to help the auditor plan the extent of control

and substantive testing to achieve the desired audit risk; an important purpose of the model in a financial statement audit is to help the auditor determine an appropriate assurance level for substantive tests.

Figure 3 presents a graphical depiction of the audit risk model applied at the relevant assertion level for financial statement audits.

Objective: Low risk that, after all testing, relevant assertions in financial statements are materially misstated.

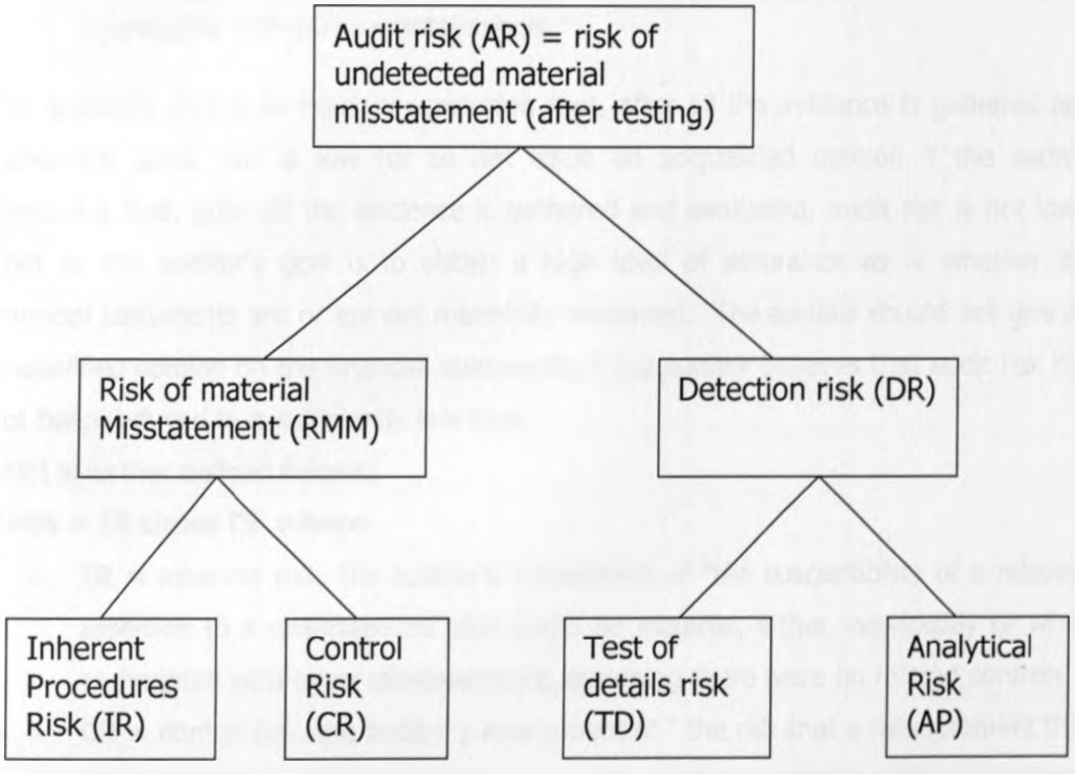

Figure 3: **The Audit Risk Model for Financial Statement Audits, applied at the relevant assertion level**

Audit risk for financial statement audits is a function of the risk of material misstatement and of detection risk. In symbols, AR (financial statement audits) = RMM times DR, where

AR=f (RMM, DR), where

- **AR** (financial statement audits) = audit risk (either desired or achieved), "the risk that the auditor may unknowingly fail to appropriately modify his or her opinion on financial statements that are materially misstated"
- **RMM** = risk of material misstatement, "the auditor's combined assessment of inherent risk and control risk" i.e., RMM is the auditor's assessment (prior to the performance of substantive testing) of the risk that the financial statements or an assertion are materially misstated.
- **DR=** detection risk, "the risk that the auditor will not detect a misstatement that exists in a relevant assertion that could be material, either individually or when aggregated with other misstatements."

The auditor's goal is to reach a conclusion that, after all the evidence is gathered and evaluated, audit risk is low (or to not issue an unqualified opinion if the auditor concludes that, after all the evidence is gathered and evaluated, audit risk is not low). That is, the auditor's goal is to obtain a high level of assurance as to whether the financial statements are or are not materially misstated. The auditor should not give an unqualified opinion on the financial statements if the auditor believes that audit risk has not been reduced to a sufficiently low level.

RMM is further defined follows;

RMM = IR times CR where

- **IR** = inherent risk, the auditor's assessment of "the susceptibility of a relevant assertion to a misstatement that could be material, either individually or when aggregated with other misstatements, assuming there were no related controls"
- **CR** = control risk, the auditor's assessment of " the risk that a misstatement that could occur in a relevant assertion and that could be material, either individually or when aggregated with other misstatements, will not be prevented or detected (and corrected) on a timely basis by the entity's internal control."

Thus, the "mathematical" depiction of the audit risk model in simple terms is **AR = IR x CR x DR.** Despite the precision implied by rendering the model in mathematical terms, in reality it is highly judgmental. The objective in an audit is to limit audit risk (AR) to a low level, as judged by the auditor.

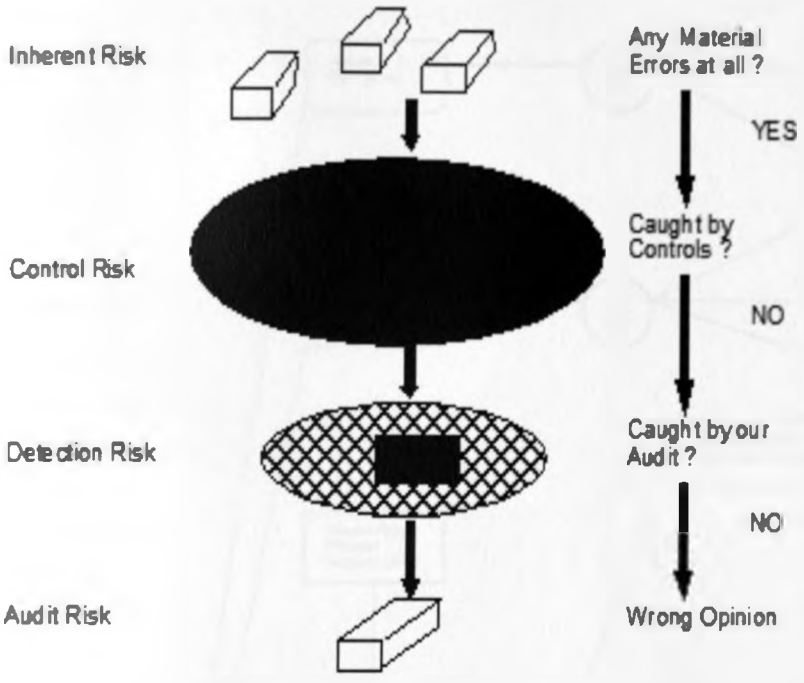

Figure 4: Audit Risk, Inherent, Control and Detection Risks in Summary.

1.3.5 Deficiency in Audit Risk

However, this audit risk model has some deficient in two major ways. One limitation is that it does not incorporate the structure of audit evidence and the second limitation is that it does not use appropriate framework for representing uncertainties in audit evidence.

These limitations are addressed by belief function framework. In general, the structure of audit evidence corresponds to a network of variables. We derive formulas only for the case in which each item of evidence bears either on all the audit objectives of an account or on all the accounts in the financial statements, so that the network is a tree shown below.

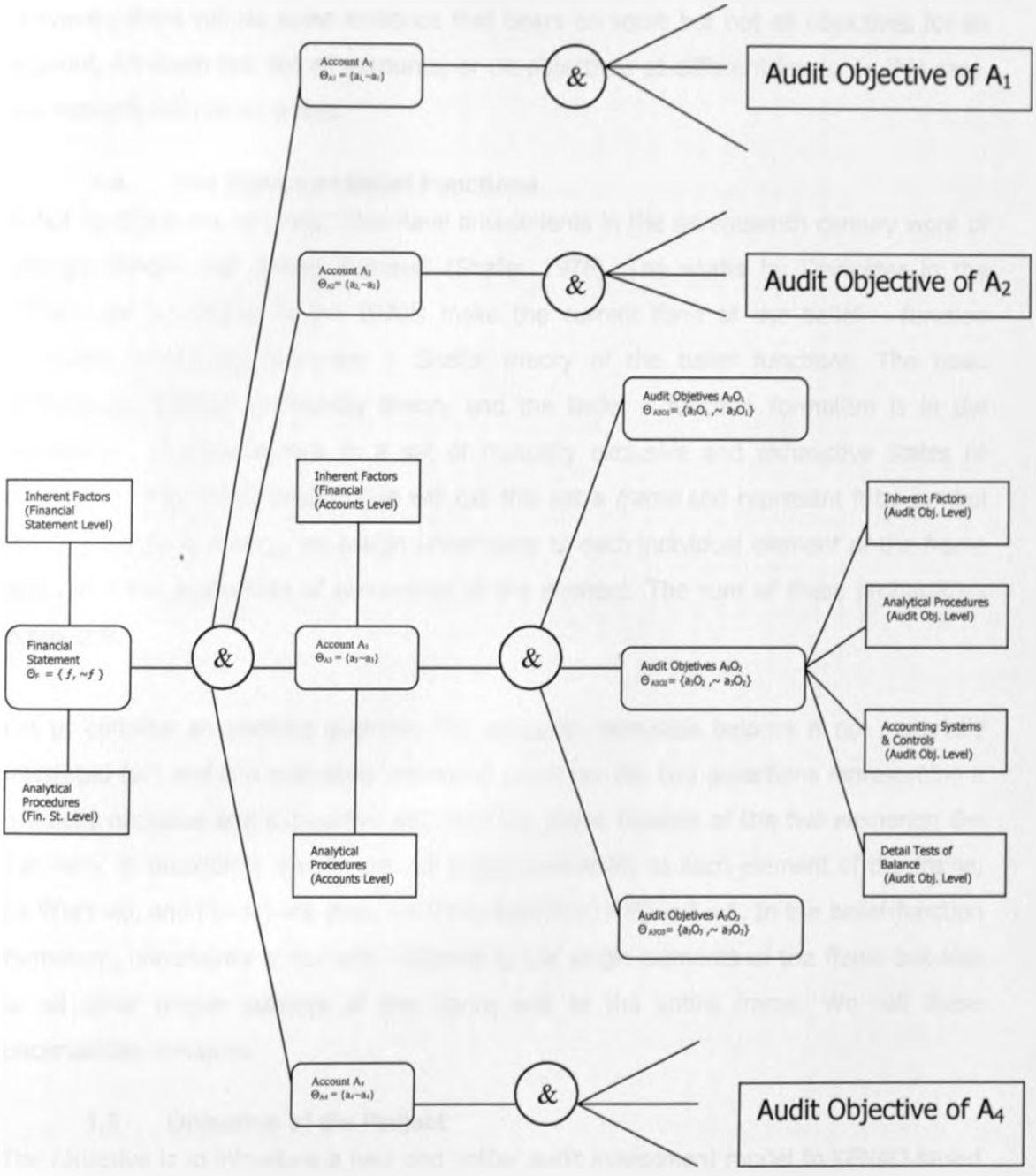

Figure 5: An Evidential Network

Note: **A rounded rectangle represents a variable (Variable being the financial statement as a whole, various accounts and the related audit objectives). A rectangle represents an item of audit evidence. The evidence is connected to a variable that it directly supports. A circle with "&" implies that the variable on the left is true if and only if the variables on the right of the circle are true.**

However, there will be some evidence that bears on some but not all objectives for an account, on some but not all accounts, or on objectives at different levels. In this case, the network will not be a tree.

1.4 The Basics of Belief Functions

Belief functions are not new; they have antecedents in the seventeenth century work of George Hooper and James Bernoulli (Shafer 1976). The works by Dempster in the 1960's and by Shafer in the 1970's make the current form of the belief – function formalism known as Dempster – Shafer theory of the belief functions. The basic differences between probability theory and the belief – function formalism is in the assignment of uncertainties to a set of mutually exclusive and exhaustive states or assertions under consideration (we will call this set a *frame* and represent it by symbol Θ). In probability theory, we assign uncertainty to each individual element of the frame and call it the probability of occurrence of the element. The sum of these probabilities equal one.

Let us consider an auditing example. The accounts receivable balance is not materially misstated (ar) and it is materially misstated (~ar) are the two assertions representing a mutually exclusive and exhaustive set. Here the frame consists of the two elements: Θ= {ar,~ar}. In probability theory, we will assign probability to each element of the frame, i.e P(ar) =0, and P(~ar) =0. Also, we know that P(ar)+ P(~ar) =1. In the belief-function formalism, uncertainty is not only assigned to the single elements of the frame but also to all other proper subsets of the frame and to the entire frame. We call these uncertainties m-values.

1.5 Objective of the Project

The objective is to introduce a new and better audit assessment model to KENAO based on the belief – function to replace the current used generic model that is outdated. The model has been customized to the specific needs of KENAO but can be applied in any other audit firm.

1.6 Problem Definition

Program planning regarding the nature, extent, and timing of procedures is critical to audit efficiency and effectiveness. The prevailing paradigm in practice to accomplish this task is the Audit Risk Model. KENAO and other local audit firms in Kenya have been using this generic audit risk model that is deficient and outdated. This is because the model fails to incorporate the structure of audit evidence and also fails to represent uncertainties in audit evidence

The purpose of this research is to examine the feasibility of a Belief-Function approach in assisting KENAO auditors on an actual engagement develop a risk-adjusted program plan. This approach has been found to be appropriate in dealing with situations such as program planning where underlying uncertainties associated with the audit evidence cannot be easily expressed in terms of probabilities. Further, assessments of risk and assurance are obtained as "beliefs", which is an evaluation that appears to be more natural and intuitive to auditors.

1.7 Project Justification

Audit program based on Belief – Function will achieve the following key objectives thus justifying this project

- This approach provides KENAO with a means to systematically aggregate risk assessments (beliefs), a task that prior research has shown to be difficult for decision-makers. This will lead to better audit decisions due to more effective and efficient audit programmes
- Will enable KENAO to produce audited accounts on timely basis as specified in the Public Audit Act 2003. This is because computerized audit programs are faster to prepare.
- Auditors will concentrate on risky areas as indicated by the audit programs prepared using Belief – Function. This will save on execution time and staff cost.
- KENAO is the only Supreme Audit Institution (SAI) in Kenya and by embracing technology in audit program planning may encourage other SAIs in Africa and

local firms to do the same thus ensuring reliability and accuracy in financial statement reporting.

The above justification is supported by the following advantages associated with the said audit programs

a) Flexibility and responsiveness

Once the necessary knowledge base has been created for a particular domain, an artificial intelligence planner can typically produce new plans very quickly and with very little user effort. This makes it useful for exploring "what if" scenarios and contingencies which are often too expensive to consider manually.

b) Intelligent Interface

A hierarchical planner has the effect of increasing the level of abstraction at which a human user can operate since it can allow problems to be posed as high- level goals and work out the detailed implications.

This makes planning quicker and also less prone to error as low- level interaction between actions are dealt with automatically.

c) Ability to maintain correctness

Plan representations demonstrate how all the casual links match up to produce a correct plan. Such representations therefore provide a basis for user modification of plans while preventing the production of incoherent or invalid plans as a result.

d) Makes assumptions explicit

In common with other KBS technologies, the explicit representation of knowledge in a planner can make it clear what is implicitly assumed in a problem that is solved manually. Thus it has a role to play in knowledge management and knowledge sharing.

e) Under the belief-function framework, we can easily distinguish between positive and negative evidence. It is also easy to express a mixed item of evidence using belief functions.

1.8 Suggested Solutions

The solution is to represent audit objectives, financial statement items and financial statements risk assessments and tests in form of a Belief – Function and use a program that will aggregate all the beliefs and give the total audit risk and resources required after considering all the networked variables.

A sensitivity analysis can also be performed to further assess the reasonableness of the output thus providing the overall desired level of assurance.

2.0 LITERATURE REVIEW

2.1 KENAO Institutional Review

2.1.1 Institutional Analysis

The Office of the Controller and Auditor General was established in 1955 under the Exchequer and Audit Act, cap 412 and subsequently entrenched in the constitution at independence in 1963.

The Public Audit Act, 2003 which became effective on 9th January 2004 established a more independent office of the Controller and Auditor General and renamed it Kenya National Audit Office (KENAO). The Office is mandated to audit all Government Ministries and Departments, Local Authorities and State Corporations. It is also mandated to carry out value for money audits. The Act further established the Kenya National Audit Commission which amongst other duties approves the budget of KENAO and determines the remuneration and other terms of appointment of staff.

The Office, headed by the Controller and Auditor General is currently structured into five departments each headed by a Deputy Auditor General. These five departments are:

- Finance, Administration and Human Resource
- Central Government
- Local Authorities
- State Corporations
- Specialized Audits

2.1.2 KENAO Role and Mandate

The Constitution of Kenya and the Public Audit Act 2003, provide for public audits and spell out the deadlines by which the Financial Statements should be prepared, submitted for audit and reports made to Parliament. KENAO is mandated to audit all accounts of the government, including:

- Treasury Accounts

- Central Government Accounts
- Local Authorities Accounts
- Corporation Accounts.

The Public Audit Act 2003 also expanded the mandate of the Office to include Value for Money Audits. In addition, KENAO has administratively established new audit units to cover the new and emerging audits, including Environmental Audits, Public Debts, Forensic Audits, Computerized Audits and Quality Assurance.

2.2 Archival Research

Archival research on program planning obtains data from actual engagements to examine the extent to which evidential plans are responsive to the level of and changes in client risks, for instance as prescribed by the Audit Risk Model. Archival studies are important since they reflect actual decisions made in practice. Such decisions are affected not only by client risks but also by economic and organizational factors such as competition, time budgets, accountability, and the use of decision aids (e.g., standard audit programs).

The earliest archival study on program planning was done by Bedard (1989) who asked auditors to identify changes made to evidential plans in the accounts receivable, inventory, and accounts payable areas and to explain the reason(s) for these changes. The nature and extent of tests were generally found to be quite stable with reductions in tests noted when controls improved or errors were not found. Mock and Wright (1993) statistically examined the relationship between risk assessments and program plans over a two-year period. A broad set of engagements and account level risks were examined. Extent was found to be related to the incidence of prior errors. However, contrary to expectations, there was not a strong association between client risks (inherent and control risks) and program plans. To test the robustness of these findings, Mock and Wright (1997) performed a follow-up study that included a more recent sample, an expanded set of risks (including financial health and risks at the assertion level), and the use of structural modeling to consider potential interdependencies between nature and extent decisions. Although program plans were found to be somewhat more responsive to risks than in the earlier study, once again a weak association was found.

In contrast, O'Keefe et. al. (1994) finds evidence that the extent of testing is related to the level of inherent risks. They examine the relationship between labor inputs (quantity and mix) and client characteristics on a cross-sectional sample of engagements conducted by a major auditing firm. They report that both the level of hours and mix (e.g., staff, senior) were significantly associated with client size complexity, leverage, and inherent risk but not with control reliance, years on the engagement, and non-audit services. These findings suggest audit plans are responsive to inherent but not control risks. However, inherent risk assessments were not taken from the working papers directly but rather the ex posts judgment of the engagement partner. Further, inherent risks were measured as a single, binary variable: more risky than average versus less risky than average.

Di Pietro et. al. (1994) report evidence that the nature of tests varies by industry (merchandising versus manufacturing) and that required tests (receivable confirmations) do not appear to inhibit planning flexibility. However, within each industry program plans were not found to be strongly related to the level of or changes in risks.

Two descriptive studies focus on the use of analytical procedures as a form of evidence. Ameen & Strawser (1994) report greater use of analytical procedures when engagements are reoccurring, controls are effective, and inherent risks are low, factors apparently relating to the presumed strength of the underlying accounting data utilized for analytical comparisons. In an interview study, Hirst & Koonce (1996) report that analytical procedures appear to be used as a substantive form of evidence primarily when the control structure is strong and, thus, the likelihood of undetected error is low. Usually simple forms of analytical procedures are employed such as a comparison of current balances or ratios to the prior year. Hirst and Koonce also note that auditors consider several factors in determining the extent of substantive analytical procedures, including inherent risk, knowledge of the client's business, client size, volume of transactions, physical location of records, and complexity of the business. These studies suggest that analytical procedures are used cautiously as a substantive test, reflecting concerns about the strength of such evidence.

In summary, contrary to the Audit Risk Model, prior archival studies have not found that program plans are closely related to client risks. This naturally leads to questions of the reasons for these findings. Mock and Wright (1997) consider this issue and identify potential factors that may account for the unexpected findings. First, they found wide use of standard audit programs, promoting stability in the nature of tests. As a result of accountability, auditors may be reluctant to not perform standard tests.

Second, the lack of a strong relationship between evidential plans and risks may result from the extremely complex cognitive process required to assess and aggregate risks and then design a program tailored to the client situation. Waller (1993) found that auditors' inherent risk assessments are only marginally associated with the rate of error and that inherent and control risk assessments do not vary across assertions (use of a "most important" heuristic). These findings suggest auditors have difficulties in assessing and aggregating client risks. Further, adapting the audit program to risks is very difficult, perhaps, as suggested by Mock and Wright (1997), leading to the use of a standard audit program.

Finally, the Audit Risk Model may not be an appropriate model to reflect the decision process that is involved in practice for program planning. For instance, business factors that are not captured in the model may play an important role. Interviews by Quadackers et. al. (1996) identifies audit practice considerations such as budget constraints, staff turnover, and litigation risks which are perceived to be important for program planning. Further, auditors may not plan tests to address risks but rather seek to provide a desired level of "assurance" or "beliefs" that the financial statements do not contain material misstatements. Thus, other frameworks such as the use of a Belief-Function approach may more appropriately capture the decision process.

The next section provides a discussion of an evidential network approach to program planning under Belief Functions. This approach has significant promise in providing a decision aid that addresses a number of the factors identified that may inhibit development of a risk-based program plan, particularly the difficulties of expressing and aggregating risks and of considering the assurance provided by evidence.

2.3 Evidential Network and Belief Functions

Srivastava and Shafer (1992) have argued that the audit risk model of Statement of Auditing Standard (SAS 47) is deficient in two major ways. One limitation is that it does not incorporate the structure of audit evidence and the other is that it does not use an appropriate framework for representing uncertainties in audit evidence. Regarding the structure of audit evidence, Figure 6 provides an illustrative belief function network that depicts program planning in one area of the audit (accounts receivable). For simplicity, we have assumed the financial statements consist of only two accounts, accounts receivable and inventory, with inventory being fairly stated with a belief of one. This network is based on risk factors and common tests performed in this area from the audit manual of KENAO. The figure includes both nodes with rounded corners (financial statement items or related objectives and assertions) and rectangles (evidential nodes related to risk assessments or to audit tests). Note that risks are at three levels: "macro" risks for the engagement such as the general control environment; "micro" risks at the account level; and a lower level of micro risks at the assertion level such as for valuation and existence. For accounts receivable these are the most important assertions in terms of likely misstatements (Waller 1993).

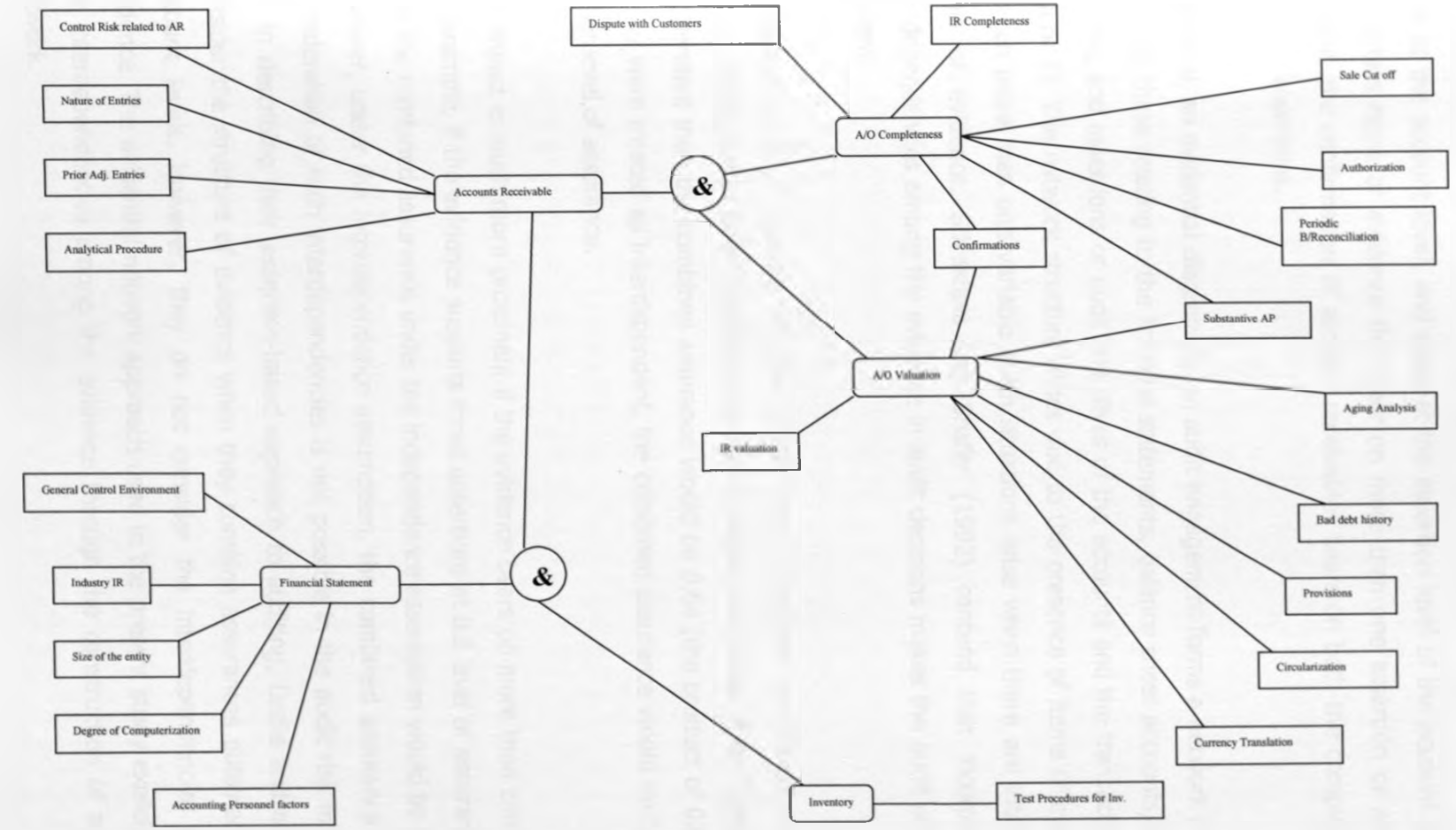

Figure 6: General Evidential Network

Figure 6 shows that some items of evidence bear upon the financial statement level, some at the account level, and some at the assertion level of the account. Also, there are certain items of evidence that bear on more than one assertion or account. For example, the confirmation of account receivables bears on both the completeness and valuation assertions.

In general, an evidential diagram for an audit engagement forms a network of variables, including those relating to the financial statements, balance sheet accounts, transaction streams, and assertions or audit objectives of the accounts and the transaction streams (Figure 6). The network structure arises due to the presence of items of evidence that bear on more than one variable. Such situations arise when there are interdependent items of evidence. Srivastava and Shafer (1992) contend that incorporating the interdependencies among the evidence in audit decisions makes the audit process more efficient.

For example, let us assume that the confirmation of account receivables provides 0.8 level of assurance to both completeness and valuation assertions. If one treats them as independent then the combined assurance would be 0.64 (the product of 0.8 and 0.8). If they were treated as interdependent, the combined assurance would be 0.8, a much higher level of assurance.

The impact is much more prominent if the evidence bears on more than two assertions. For example, if the evidence supports three assertions at 0.8 level of assurance to each, then the combined assurance under the independence assumption would be 0.51 (0.8^3). However, under the interdependence assumption, the combined assurance is still 0.8. Consideration of such interdependencies is not possible in the audit risk model of SAS 47. In describing their assertion-based approach to auditing, Leslie and et. al (1986) consider the structure of evidence when they combine assurances obtained at various account levels. However, they do not consider the interdependencies among the evidence. The evidential network approach used in the present study explicitly captures the interdependencies among the evidence through the construction of an evidential network.

The second limitation with the audit risk model of US Statement of Auditing Standard (SAS 47) deals with the representation of uncertainties in the evidence. It is generally accepted that the audit risks in the model are measured in terms of probabilities. However, the probability interpretation is problematic as is pointed out by Srivastava and Shafer (1992):

> *... according to SAS 47, if an auditor decides not to consider inherent factors, then the inherent risk is set equal to 1. Since a probability of 1 means certainty, this seems to be saying that it is certain that the account is materially in error. But this is not what the auditor has in mind when deciding not to depend on inherent factors. The auditor's intention is represented better by belief-function plausibility of 1 for material error, which says only that the auditor lacks evidence based on inherent factors.*
>
> *In a less extreme situation, the auditor may believe, on the basis of inherent factors that the account is fairly stated and yet be unwilling to rely on theses factors past a certain point. In this case, the auditor may, as SAS No. 47 suggests, assign a value less than the maximum, say 70 percent, to inherent risk. If interpreted in probability terms, this number says that the inherent factors give a 30 percent chance that the account is not materially misstated and a 70 percent chance that it is materially misstated. This suggests that the evidence is negative, contrary to the auditor's intuition. The probability interpretation is even more confusing if the auditor sets the inherent risk at 50 percent. What does this mean? Does it mean that the auditor is completely ignorant about the state of the account, or does it mean there is more evidence that the account is not being materially misstated than when only 30 percent assurance was assumed?*

Belief functions provide a flexible and adaptable framework for representing uncertainties and combining evidence (Akresh et al. 1988). Since belief functions permit uncommitted beliefs, they provide a framework for interpreting the auditor's choice in a

straightforward manner. For example, when the auditor sets the inherent risk at 70 percent based say on moderate positive audit planning evidence, this judgment implies that the evidence indicates a 30 percent degree of support that there are no material errors. This then leaves 70 percent of the auditor's belief uncommitted. Based on just the positive evidence that led to the 70% inherent risk factor, the auditor has no evidence that the account is materially misstated. However, there still is 70 percent plausibility that the account could be materially misstated.

Moreover, the belief-function interpretation of risk appears to be more intuitively appealing than the probability interpretation. For example, suppose the auditor has performed analytical procedures related to an account and finds the recorded balance to be reasonable but does not want to put much weight on this evidence. Based on just this evidence, an auditor may assign a low level of support, say 0.2, that the account is not materially misstated ('a'). Under a probability framework, this assessment is interpreted as if the auditor is implying that the account is materially misstated ('~a') with 0.8 level of support. However, the auditor may believe that the positive analytical procedures evidence provides no indication that the account is materially misstated. Under belief functions, the remaining 0.8 degree of support represents an uncommitted belief that is assigned to the entire frame. In terms of belief functions these judgments can be expressed as Bel(a) = 0.2 and Bel(~a) = 0, or in terms of m-values as m(a) = 0.2, m(~a) = 0, and m({a,~a}) = 0.8.

In the evidential network approach under belief functions, items of evidence are combined using Dempster's rule of combination.

The evidential network approach for audit decisions is a comprehensive way to capture all the evidence and their interrelationships, and also to consider the relationships among assertions or audit objectives, and the relationship among accounts and financial statements. Using belief functions for representing uncertainties in the evidential reasoning approach makes the process more effective for the following reasons. First, under the belief-function framework, we can easily distinguish between positive and negative evidence. For example, suppose an item of evidence supports an account that

it is fairly stated ('a') with, say, 0.2 level of assurance, and provides no support for its negation. This evidence can be expressed in terms of belief functions as Bel(a) = 0.2, and Bel(~a) = 0 or in terms of m-values as m(a) = 0.2, m(~a) = 0, and m({a,~a}) = 0.8. Similarly, a weak negative item of evidence with, say, 0.3 level of support that the account is materially misstated, ~a, and no support for 'a' can be expressed as Bel(a) =0, and Bel(~a) = 0.3, or m(a) = 0, m(~a) = 0.3, and m({a,~a}) =0.7.

Second, we can easily express a mixed item of evidence using belief functions. For example, if an item of evidence provides, say, 0.2 level of assurance that the account is fairly stated, and 0.3 level of assurance that the account is not fairly stated then one can write this as Bel(a) = 0.2, Bel(~a) = 0.3 or in terms of m-values as m(a) = 0.2, m(~a) = 0.3, and m({a,~a}) = 0.5. Third, in the evidential network approach, each item of evidence is directly connected to the variable it pertains to and thus the impact of the evidence is direct. Suppose that the inherent factors such as economic factors, industry related factors, management related factors, all together provide combined negative evidence, say, 0.10 level of assurance that an account is not fairly stated and no support to 'a' that the account is fairly stated, i.e., Bel(~a) = 0.10 and Bel(a) = 0. Although there is no support to 'a', the plausibility that the account is fairly stated is still 0.9. ***Plausibility represents the maximum level of assurance that could be obtained, given the current information, assuming that all the subsequent items of evidence are in its favor.*** However, if 0.95 is the threshold level of assurance to accept the account balance as fairly stated, then the auditor would not accept the account in the above example. Instead, the auditor could either collect more evidence or decide that an adjustment is needed. Based on additional evidence, the auditor could either conclude that the 0.95 threshold has been achieved or again determine that an adjustment needs to be made.

It should be noted that continuous values may be elicited to quantify these beliefs or alternatively discrete values may be obtained (e.g., high, medium, and low risk). In practice, auditors usually do not express uncertainties in terms of numerical values, but rather use discrete scales such as "high" or "low" risk. Thus, discrete elicitation scales

may lead to greater acceptability and ease of use among auditors than continuous probability scales.

2.4 m-values

Similar to probabilities, all m-values add to one. For the example given earlier, we will have m(ar) =0, m(~ar) =0, and m({ar, ~ar })=1, and, m(ar)+ m(~ar)+ m({ar, ~ar })=1. Let us assume that the auditor has performed analytical procedures relevant to the accounts receivable balance and finds no significant difference between the recorded value and the predicted value. Based on this finding, he feels that the recorded value appears reasonable and is not materially misstated. However, he does not want to put too much weight on this evidence. He feels he can assign a small level of assurance, say 0.3 on a scale of 0-1, that the account is not materially misstated. We can express this feeling in terms of m-values as: m(ar) =0.3, m(~ar) =0, and m({ar, ~ar })=0.7. The belief function interpretation of these m-values is that the auditor has 0.3 level of support to 'ar', no support to '~ar', and 0.7 level of support remains uncommitted which represents ignorance.

However, if we had to express the above feelings in terms of probabilities then we get into problems because we will assign P(ar) =0.3 and P(~ar) =0.7 which implies that there is a 70 percent chance that the account is materially misstated, but we know that this is not what the auditor is trying to say. The auditor has no reason to believe that the account is materially misstated. Thus, we can use m-values to express the basic judgement about the level of support or assurance the auditor obtains from an item of evidence for an assertion. An example of a negative item of evidence which will have a direct support for '~ar' would be the following set of inherent factors: (1) in the prior years the account has had major problems, and (2) there are economic reasons for management to misstate the account. In such a case we can express the auditor's feelings as m(ar) =0, m(~ar) =0.2, and m({ar, ~ar })=0.8, assuming that the auditor feels a low, say 0.2, level of support for '~ar'.

The auditor can express a mixed-type of evidence in terms of m-values without any problems. For example, consider that the auditor has accumulated several environmental factors, some in support of and some against the assertion that the

accounts receivable balance is not materially misstated. He assesses that there is a moderate, say 0.4, level of support in favor of the assertion and a low level of support, say 0.1, for its negation, and feels that he cannot assign the remaining 0.5 level of support to any particular state. We can expressed this feeling as: m(ar) =0.4, m(~ar) =0.1, and m({ar, ~ar})=0.5. In probability theory, we cannot express such a feeling.

2.5 Illustration of Belief Functions

So far we have talked about probabilities and m-values. Let us now define the belief function, Bel(A) for a subset A of elements of the frame. Bel(A) represents the total belief in A. This belief will be more than m(A). Actually, Bel(A) is equal to m(A) plus sum of all the m-values for the set of elements that are contained in A. By definition, belief in the empty set is zero.

Let us consider an example to illustrate the definition of belief functions. Suppose you have a friend who lives on the Kenyan Coast in the North Coast area. The only contact you have with him is through greeting cards that he sends you periodically with no return address. You want to find the belief that your friend lives in North Coast. After looking through all the cards you have received over the years, you can identify the following post-office seals marked on the cards: 10% of the cards are marked Mtwapa, 20% Kilifi, 10% ukunda, and 15% Nyali. Thirty percent of the cards have only the Bamburi part legible which means you cannot determine from what part of Bamburi the card was mailed. For the remaining 15%, nothing is legible on the seals. These numbers can be interpreted as non-zero m-values for different subsets of the frame that your friend lives somewhere on the North Coast. Based on just this evidence, you wish to form your total belief that the friend lives in North Coast. This belief will be the sum of the m-values that he lives in Mtwapa, Kilifi, Bamburi and Nyali. For this example, the belief is 0.75.

Going back to our auditing example of analytical procedures, the auditor's assessment of the level of support in terms of m-values was: m(ar) =0.3, m(~ar) =0, and m({ar,~ar})=0.7. Based on analytical procedures alone, the belief that the account is not materially misstated is 0.3 (i.e Bel(ar) =0.3) and no support that the account is materially misstated (Bel(~ar) =0). In general, a zero belief in the belief function

formalism means that there is no evidence to support the proposition. In other words, a zero belief in a proposition represents lack of evidence. In contrast, a zero probability in probability theory means that the proposition cannot be true which represents impossibility. Also, one finds that beliefs for 'ar' and '~ar' do not necessarily add to one, i.e Bel(ar) + Bel(~ar) =1, whereas in probability, it is always true that P(ar) +P(~ar) =1.

Belief functions differ from probabilities in representing ignorance. In probability theory, we represent ignorance by assigning equal probability to all outcomes or elements of the frame. In the belief-function framework, we represent ignorance by assigning an m-value of one to the entire frame and an m-value of zero to all its proper subsets. The belief-function formalism becomes the Bayesian formalism when non-zero m-values exist only for single elements of the frame. In such a case, m-values become probabilities, i.e, $m(a_i) = P(a_i)$, and Dempster's rule in the belief-function formalism becomes Bayes' rule in the probability theory (Shafer 1976).

2.6 Plausibility functions

By definition, the plausibility of A is given by: Pl(A) = 1 – Bel (~A) where ~A represents the set of elements that are not in A. Intuitively, the plausibility of A is the degree to which A is plausible given the evidence. In other words, Pl(A) is the degree to which we do not assign belief to its negation ~A.

In our example of analytical procedures, we have Bel (ar)=0.3, Bel(~ar)=0.These values yield the following plausibility values: Pl(ar)=1, and Pl(~ar)= 0.7. Pl(ar)=1 indicates that 'ar' is maximally plausible since we have no evidence against it. However, Pl(~ar) = 0.7 indicates that if we had no other items of evidence to consider then the maximum possible risk that the account is materially misstated would be 0.7,even though we have no evidence that the accounts is materially misstated (Bel(~ar)=0). The plausibility function for the assertion that the account is materially misstated is the belief- function interpretation of the audit risk associated with the evidence.

2.7 The Structure of Audit Evidence

As we have seen, neglect of the structure of audit evidence has been a problem in audit risk models. Before developing belief-function formulas we must, therefore, specify carefully the kind of structure we are considering.

We will adopt the structure currently assumed in auditing standards (AICPA 1988a; see also, e.g., Arens and Loebbecke 1988), with some simplifications. The standards generally divide audit evidence into four categories: (1) general knowledge about inherent risk, (2) evidence from analytical procedures, (3) knowledge of control factors and accounting systems, and (4) tests of details of balances. Within each general category, further structure arises because of the relevance of different items of evidence to different accounts and different objectives. In the following subsections, we review the structure within each of the four categories.

2.7.1 General Knowledge about Inherent Risk

In this category, we include general knowledge about risk factors that lie outside of the accounting system and also outside of the auditor's control. Examples include economic, political, business and regulatory environments, experience from the prior year's audit, management philosophy and style, organizational structure, and audit committee. Also included in this category are factors that make individual accounts more or less susceptible to error, such as the complexity of transactions, the volume of transactions processed, the susceptibility of assets to defalcation, and related party transactions. Such factors are important for the auditor's planning decisions, since the extent, nature, and timing of tests will depend on the auditor's assessment of the effect of these factors on the individual accounts and on the financial statement as a whole.

Some inherent factors affect entire financial statements, whereas others affect only certain accounts or classes of transactions. Some affect only a particular audit objective for an account or a class of transactions. Information about the competence and integrity of management, for example, will affect the entire financial statement. The auditor will have a higher-level of assurance about the financial statement when

management is of recognized competence and integrity than when management is known to have been involved previously in irregularities. In contrast, an auditor auditing a newspaper publisher realizes that libel suits against newspapers are common and will treat this knowledge as evidence affecting only accrued-contingent liability. The nature and complexity of an individual account (e.g., susceptibility to defalcation, volume of transactions, non-routine transactions, account balance based on management's judgment) also may affect only that account. As an example of evidence that affects only a certain audit objective, we might cite information about related party transactions from the minutes of board meetings. This information affects only the disclosure and classification objectives of the accounts involved in the transaction.

In summary, we see that evidence about inherent factors can bear on the financial statement at three different levels: (1) the financial statement level, (2) the individual account or class of transactions level, and (3) the audit objective level for individual accounts or classes of transactions. See Figure 5 for details.

2.7.2 Analytical Procedures

According to SAS No. 56 (para. 2),

> Analytical procedures are an important part of the audit process and consist of evaluations of financial information made by a study of plausible relationships among both financial and non-financial data. Analytical procedures range from simple comparisons to the use of complex models involving many relationships and elements of data.

The statement proposes that analytical procedures be used for the following purposes (para. 4):

1. To assist the auditor in planning the nature, timing and extent of other auditing procedures.
2. As a substantive test to obtain evidential matter about particular assertions related to account balances or class of transactions.

3. As an overall review of the financial information in the final review stage of the audit.

The expected effectiveness and efficiency of an analytical procedure depends on (1) the nature of the audit objectives, (2) the plausibility and predictability of the relationship, (3) the reliability and availability of the data used to develop the expectation, and (4) the precision of the expectation.

Like general knowledge about inherent factors, analytical procedures can provide assurance at various levels. The more common analytical procedures seem to provide assurance at either the account level or the audit objective level. A comparison of the previous year's accounts payable with the current period's accounts payable provides assurance for the accounts payable balance as a whole. A comparison of the previous year's ratio of bad debt expense to accounts receivable balance with the current year's ratio would bear on collectibility of accounts receivable, a valuation objective.

For the purpose of completeness, we will assume analytical procedures to be effective at all three levels: (1) the financial statement level, (2) the account or class of transactions level, and (3) the audit objective level for accounts or classes of transactions. When certain items of evidence are not to be considered in an audit, then those items are eliminated by setting the corresponding plausibilities to 1.

2.7.3 Control Factors and Accounting Systems

We include in this category all items of evidence related to accounting systems, control procedures, and tests of transactions. A test of controls typically bears on the audit objective level of an individual account, while a test of transactions typically bears on the audit objective level of a class of transactions. Controls built into a cost accounting system, for example, bear on the valuation objective of inventory, while the use of pre - numbered bills of lading and sales invoices periodically accounted for bears on the completeness objective of sales.

2.7.4 Tests of Details of Balances

Tests of details of balances bear primarily on the audit objective level. Since it is costly to obtain this type of evidence, the auditor minimizes the need for it by maximizing the assurance to accounts and audit objectives from other sources.

Some tests of details of balance bear on only one audit objective, while others may bear on more than one. A review of the minutes of board meetings to check whether receivables have been factored bears only on the ownership objective of accounts receivable, but confirmations of accounts receivable by customers provide assurance for both the existence and valuation objectives. In general, such assurances may vary in strength from objective to objective. For example, confirmation of accounts receivable may provide a higher level of support for the existence objective than for the valuation objective.

When an item of evidence bears equally on all the objectives of an account or all the accounts of the financial statement, we can represent it within a tree structure by linking it directly to the account or the financial statement, as the case may be. But when a test provides support to more than one audit objective, say, but not equally to all the objectives at once, we obtain a network of variables that is not a tree, and this makes the derivation of formulas cumbersome. The formulas given here are based on the assumption that the network is a tree, but they can be used as approximations in the non-tree case. One way to use them as approximations is to treat the evidence as if it consisted of independent items of evidence bearing on the different objectives. The formula for the total audit risk (i.e., total plausibility of error) at the audit objective level will still be valid (i.e., it maintains its multiplicative form) when we do this, but the formulas at the account level and the financial statement level will provide only a conservative estimate of the total risk (i.e., plausibility of error). For example, suppose that confirmations of accounts receivable yield 0.9 level of assurance that both existence and valuation objectives are met. If we treat this as two items of evidence, one giving 0.9 degree of support for existence and one giving 0.9 for valuation, then our formulas give a total assurance, for the two objectives jointly, of 0.9 x 0.9 = 0.81, corresponding

to a risk (plausibility of error) of 0.19. But the correct value for the assurance is 0.9, corresponding to a risk of 0.1.

2.8 Belief-function Approach to Audit Evidence

In this section, we review the belief-function approach to representing uncertainties in audit evidence. The belief-function framework involves three related representations for beliefs concerning a topic: the belief function (**Bel**), the plausibility function (**PL**), and the basic probability assignment (**m**). As we will explain, the basic probability assignment is often convenient for expressing initial judgments, but the plausibility function is useful for expressing final judgments about audit risk.

The basic probability assignment is also called the **m**-function, and its values are called **m**-values (Shafer 1976). The basic difference between **m**-values and probabilities is that probabilities are assigned to individual elements of a frame, say Θ, whereas **m**-values are assigned to a subset of elements of the frame. The sum of all the **m**-values for all the subsets of the frame Θ is 1. Formally, the **m**-function assigns a number **m**(B) to each subset B of Θ such that **m**(Ø) = 0 (Ø being the empty set) and

$$\sum_{B \subseteq \Theta} \mathbf{m}(B) = 1.$$

There are two ways to obtain **m**-values on a frame: (1) they may be assigned directly by the decision maker on the basis of subjective judgment and (2) they may be derived from a compatibility relationship between a frame with known probabilities and the frame of interest. We will use the first approach to discuss our example.

Suppose the auditor has performed a set of analytical procedures appropriate to account 'A' and finds no discrepancy or errors in the account. On the basis of this observation, the auditor feels that the evidence is positive and provides a medium level of support, say 0.6, to '*a*' that the account is not materially misstated. However, at the same time, the auditor feels that there is nothing to indicate that the account is materially misstated (~*a*). This means that 0.6 degree of support is assigned to '*a*', 0 to '~*a*', and the remaining 0.4 is the ignorance assigned to the entire frame Θ = {*a*,~*a*}; that is,

$\mathbf{m}_{PA}(a) = 0.6$, $\mathbf{m}_{PA}(\sim a) = 0$, and $\mathbf{m}_{PA}(a, \sim a) = 0.4$,

where the subscript PA stands for analytical **p**rocedures at the **a**ccount level. The above set of **m**-values represents affirmative evidence.

As mentioned earlier, we will consider only affirmative evidence in our derivation of audit risk formulas. Although the approach of aggregating evidence discussed in this article is valid for any type of evidence, use of affirmative evidence avoids the renormalization procedure in aggregating various items of evidence and thus yields simple analytical formulas.

Let us go back to our example of analytical procedures discussed above and express the auditor's judgment about the level of support obtained (or to be obtained when planning the audit) from the procedures for account 'A' in terms of algebraic expressions:

$\mathbf{m}_{PA}(a) = 1$ - APRA,

$\mathbf{m}_{PA}(\sim a) = 0$,

and

$\mathbf{m}_{PA}(\{a, \sim a\})$ = APRA,

where APRA represents a number. Equation (1) implies that the analytical procedures performed by the auditor for account 'A' provide assurance that the account is not materially misstated with (1 - APRA) degree of support.

2.8.1 Belief Functions and Plausibility Functions

In general, the total belief in a subset B of the frame Θ is given by:

$$\mathbf{Bel}((B) = \sum_{X \subseteq B} \mathbf{m}(X),$$

where X represents a set of elements of Θ, and the plausibility of B is given by

$$\mathbf{PL}(B) = \sum_{B \cap X \neq \emptyset} \mathbf{m}(X) = 1 - \mathbf{Bel}(\sim B).$$

Intuitively, the plausibility of B is the degree to which B is plausible in the light of the evidence (the degree to which we do not disbelieve B or assign belief to its negation ~B). Complete ignorance or lack of opinion about B is represented by

Bel(B) = 0 and **PL**(B) = 1.

Consider again the numerical example discussed above. We have **m**PA(*a*) = 0.6,

mPA(~*a*) = 0, and **m**PA(*a*,~*a*) = 0.4. From (4) and (5), we obtain
BelPA(*a*) = **m**PA(*a*) = 0.6,
BelPA(~*a*) = **m**PA(~*a*) = 0,
BelPA({*a*, ~*a*}) = **m**PA(*a*) + **m**PA(~*a*) + **m**PA(*a*,~*a*) = 0.6 + 0 + 0.4 = 1.0 ,
And
PLPA(*a*) = 1 - **Bel**PA(~*a*) = 1,
PLPA(~*a*) = 1 - **Bel**PA(*a*) = 1 - 0.6 = 0.4.

The intuitive meaning of **Bel**PA(*a*) = 0.6 is that the auditor has direct evidence from analytical procedures relevant to account 'A' that '*a*' is true with 0.6 degree of support (i.e., the account is not materially misstated with degree 0.6). **Bel**PA(~*a*) = 0 means that the auditor has no evidence from analytical procedures that the account is materially misstated (i.e., ~*a* is true).

Let us now consider **PL**PA(*a*) = 1. What does it mean? We know that analytical procedures provide no belief to ~*a* (**Bel**PA(~*a*) = 0). Since there is no support committed to just ~*a*, all the probability mass could be assigned to *a*, which implies that **PL**PA(*a*) = 1. Similarly, since **Bel**PA(*a*) = 0.6 (i.e., 0.6 degree of belief is directly committed to *a*), the remaining amount 0.4 of uncommitted probability mass could be assigned to ~*a*; that is, **PL**PA(~*a*) = 0.4.

Going back to the **m**-values in equations (1) - (3), we obtain the following beliefs and plausibilities:

BelPA(a) = 1 - APRA, **Bel**PA($\sim a$) = 0, and **Bel**PA($\{a, \sim a\}$) =1,
and
PLPA(a) = 1, and **PL**PA($\sim a$) = APRA.

The plausibility function, **PL**PA($\sim a$) = APRA, has an important interpretation. It provides a non-frequentist interpretation of the auditing concept of risk. This is a measure of how risky we feel it would be to stop with this evidence. According to the analytical procedures performed at the account level, we have (1 - APRA) degree of belief that a is true, leaving a plausibility of **PL**PA($\sim a$) = APRA that the account is materially misstated. This is the audit risk associated with the analytical procedures performed at the account level.

This plausibility interpretation of audit risk is conceptually in agreement with the thought process of the auditor when planning an audit. For example, if the auditor plans an audit of an account to obtain an overall assurance of 0.95 (i.e., **Bel** (a) = 0.95) that the account is not materially misstated then, in plausibility terms, it means that the auditor is planning the audit at the 0.05 level of plausibility for material error in the account (i.e., **PL**($\sim a$) = 0.05). In other words, if the auditor had to stop after obtaining 0.95 level of assurance that 'a' was true, then the evidence gathered up to that point would suggest that '$\sim a$' is plausible with degree 0.05; that is, there is a *maximum* risk of 0.05 that the account is materially misstated.

In general, **Bel**(B) $\leq$ **PL**(B) for every subset B of our frame Θ. If we believe B, then we think B is plausible, but the converse is not necessarily true. A zero plausibility for a proposition means that we are sure that it is false (like a zero probability in the Bayesian theory), but a zero degree of belief for a proposition means only that we see no reason to believe the proposition.

Similar explanations can be given to the **m**-values, belief functions, and plausibility functions for the other seven items of evidence presented in Figure 5. The individual **m**-values obtained in Figure 5 combined with Dempster's rule (1 - IR_FAPR_F) will give us the overall belief that the financial statement is fairly presented. Since these **m**-values are

defined at different nodes in an evidential network (e.g., see Figure 5), combining them becomes a problem of propagating **m** - values (or belief functions) through the network.

2.9 Audit-risk Formulas in the Belief-function Framework

In this section, we give formulas for the overall plausibility of material misstatement at various levels of the financial statement.

2.9.1 Total Audit Risk (Plausibility of Material Misstatement) at the Financial Statement Level

We have the following expression for total plausibility of material misstatement at the financial statement level:

$$\mathbf{PL}^{t}_{F}(\sim f) = AR^{t}_{F} = IR_F APR_F \left[1 - \prod_{A} (1 - AR_A)\right], \quad (1)$$

where AR_A and AR_{AO} are defined as:

$$AR_A = IR_A APR_A \left[1 - \prod_{O} (1 - AR_{AO})\right], \quad (2)$$

And

$$AR_{AO} = IR_{AO} APR_{AO} CR_{AO} DR_{AO}. \quad (3)$$

Also, the total belief that the financial statement is fairly presented is given by:

$$\mathbf{Bel}^{t}_{F}(f) = 1 - IR_F APR_F \left[1 - \prod_{A} (1 - ARA)\right]. \quad (4)$$

Equation (1) represents total plausibility of material misstatement in the financial statement or total audit risk, AR^{t}_{F}, at the financial statement level. The total belief that the financial statement is not materially misstated is given by (11). It should be noted that the algebraic form of (1) is very different from the formula discussed in SAS No. 47 or the Bayesian model. Unlike the audit risk model of SAS No. 47 or the Bayesian model, equation (1) takes into consideration all the evidence at all the levels of the financial

statement. It also differs from SAS No. 47, of course, in the interpretation. Here, we interpret audit risk as a plausibility, not as a probability.

2.9.2 Total Audit Risk (Plausibility of Material Misstatement) at the Account Level

We have the following expression for total plausibility of material misstatement at the account level:

$$\mathbf{PL}^{t}{}_{A}(\sim\partial) = AR^{t}{}_{A} = IR_{F}APR_{F}IR_{A}APR_{A}\left[1 - \prod_{O}(1 - AR_{AO})\right], \qquad (5)$$

and the total belief that account 'A' is not materially misstated as:

$$\mathbf{Bel}^{t}{}_{A}(\partial) = 1 - AR^{t}{}_{A} = 1 - IR_{F}APR_{F}IR_{A}APR_{A}\left[1 - \prod_{O}(1 - AR_{AO})\right], \qquad (6)$$

Here, equation (5) represents total plausibility of material misstatement or total audit risk, $AR^{t}{}_{A}$, at the account level. The total belief or assurance that the account is not materially misstated is given by (6). It is again the result of aggregating all the evidence at the account level, whether the evidence is coming from the audit objective level, the financial statement level, or directly bearing on the account. It again differs from the Bayesian or SAS No. 47 formula. In (5), we find that $AR^{t}{}_{A}$ is the product of three types of plausibilities: (1) plausibility arising from inherent factors (i.e., the inherent risk, $IR_{F}IR_{A}$), (2) plausibility arising from analytical procedures (i.e., the analytical procedure risk, $APR_{F}APR_{A}$), and (3) plausibility arising from the evidence at the audit objective level for the account (i.e., the combined audit risk, $[1 - \Pi_{O}(1 - AR_{AO})]$). The third term represents 1 minus the level of support obtained from the procedures performed at the audit objective level. If no procedures are performed at that level, which means $AR_{AO} = 1$, then the support is zero and the third term equals 1.

2.9.3 Total Audit Risk (Plausibility of Material Misstatement) at the Audit Objective Level

The total plausibility of material misstatement and total belief at the audit objective level are as given below

$$\mathbf{PL}^{t}_{AO}(\sim ao) = AR^{t}_{AO} = IR_F APR_F IR_A APR_A AR_{AO}; \quad (7)$$

$$\mathbf{Bel}^{t}_{AO}(ao) = 1 - IR_F APR_F IR_A APR_A AR_{AO}; \quad (8)$$

Equation (7) represents the total plausibility that the audit objective 'AO' will not be met when all the evidence at various levels has been aggregated. The total belief that the objective will be met is given by (8). As seen in (7), the total risk at the audit objective level is the product of three terms, ($IR_F APR_F$), ($IR_A APR_A$), and ($IR_{AO} APR_{AO} CR_{AO} DR_{AO}$), each defined at different levels. This formula resembles the multiplicative formula of SAS No. 47 if we separate the risks associated with inherent factors and analytical procedures:

$$AR^{t}_{AO} = (IR_F IR_A IRA_O)(APR_F APR_A APR_{AO})(CR_{AO} DR_{AO}). \quad (9)$$

The first factor in (9) determines the overall risk associated with inherent factors. Similarly, the second term represents the overall risk associated with analytical procedures performed at all levels. The third term is the product of control risk and detection risk. We must repeat that, although (9) is similar to the SAS No. 47 model, our interpretation of the risk is very different.

3.0 METHODOLOGY

The study examined the use of a Belief – Function approach in program planning by examining actual audit programs in the account receivable area. An audit plan (Appendix A) for a manufacturing firm was prepared. The purpose this plan (questionnaires) was to document client's specific information to assist in risk assessment based on the environmental factors among other things (see appendix C).

The methods involves developing an evidential model of an actual audit (See chapter 4), eliciting beliefs from the auditors who conducted the audit and performing sensitivity analyses to evaluate the model (see 5.2)

In eliciting beliefs auditors were asked the following questions for each item of evidence obtained.

Considering each item of evidence in isolation, that is ignoring all other audit evidence, what is the amount of support provided either supporting and/or not supporting the related assertion?

Beliefs were elicited by visiting the auditors in their offices and providing background information concerning the research project and general instructions concerning beliefs and how they relate to probability. The particular client studied was briefly discussed with auditors who gave an assurance that they are very familiar with the details of the client and felt comfortable in providing the requisite beliefs.

The beliefs were elicited at the financial statement level, accounts level and audit assertion level. For instance, in respect to collectibility of account receivables, he was asked to consider the evidence that was collected in tests of bad debt provision and estimate the amount of evidence either supporting and/or not supporting the collectibility assertion.

The general areas where beliefs were elicited as detailed in appendix A & B are:

Evidence at financial statement levels

- General control environment
- Liquidity Factors

- Internal control functions
- Accounting personnel factors

Evidence at accounts level

- Analytical procedures
- Control factors related to audit risk

Evidence at objective level

- Evidence at accounts receivables Completeness level
- Evidence at accounts receivables Valuation level

From these initial beliefs an evidential model was developed that reflected a network of variables (Fig 4) and how they influence one another. Belief – function formulae shown in 2.9 and 4.1 were applied to calculate the total audit risk based on the initial beliefs. To further assess the reasonableness of the output of the model, sensitivity analysis was performed.

To get the users feedback a questionnaire (See appendix E) was developed to collect their views on the applicability of the project in KENAO.

4.0 MODEL AND PROTOTYPE

4.1 Developing an Evidential Model

The initial steps entailed developing an evidential model based on an actual audit of KENAO. Next we reviewed the standard audit program used in this office to audit the accounts receivable as an example.

KENAO tailors the standard audit program **(Appendix B)** to the particular client being audited. Once the tailored audit program was obtained the evidential network (model) was developed using an approach similar to that used by Mock & Wright (1993). First, risk assessments and audit demographics were obtained by asking a senior officer familiar with the audit to complete a detailed questionnaire while reviewing the working papers actually generated during the audit. A copy of the questionnaire (audit plan) is contained in **Appendix A** which documents client financial information, the fee basis used, planned audit hours and other key data.

Second, a copy of the actual audit program was made for our review **(see Appendix B)**. Based on both of these sources and the risk assessment factors **(See Appendix C)** a generic model depicted in Figure 6 was developed which focuses on accounts receivable and the Completeness and valuation assertions.

Based on this information the auditor professionally assessed the inherent and analytical procedures as follows:

- Inherent risk at Financial statement level (IR_F) =0.7,
- Inherent risk at accounts level (IR_A) =0.6,
- Analytical procedure at Account level (APR_A) =0.4,
- Analytical procedure at Financial statement level (APR_F) =1

The following belief – function formulae were applied to calculate total audit risk at various levels:

Total Audit Risk at the Financial Statement Level

$$AR^{t}_{F} = IR_F APR_F [1 - \Pi (1 - AR_A)],$$

Total Audit Risk at the Account Level

$AR^{t}_{A} = IR_{F}APR_{F}IR_{A}APR_{A}\left[1 - \prod (1 - AR_{AO})\right]$,

Total Audit Risk at the Audit Objective Level

$AR^{t}_{AO} = IR_{F}APR_{F}IR_{A}APR_{A}AR_{AO}$;

This formula resembles the multiplicative formula **AR = IR x CR x DR** if we separate the risks associated with inherent factors and analytical procedures:

$AR^{t}_{AO} = (IR_{F}IR_{A}IRA_{O})\ (APR_{F}APR_{A}APR_{AO})\ (CR_{AO}DR_{AO})$.

4.2 Prototype

4.2.1 Prototype Design

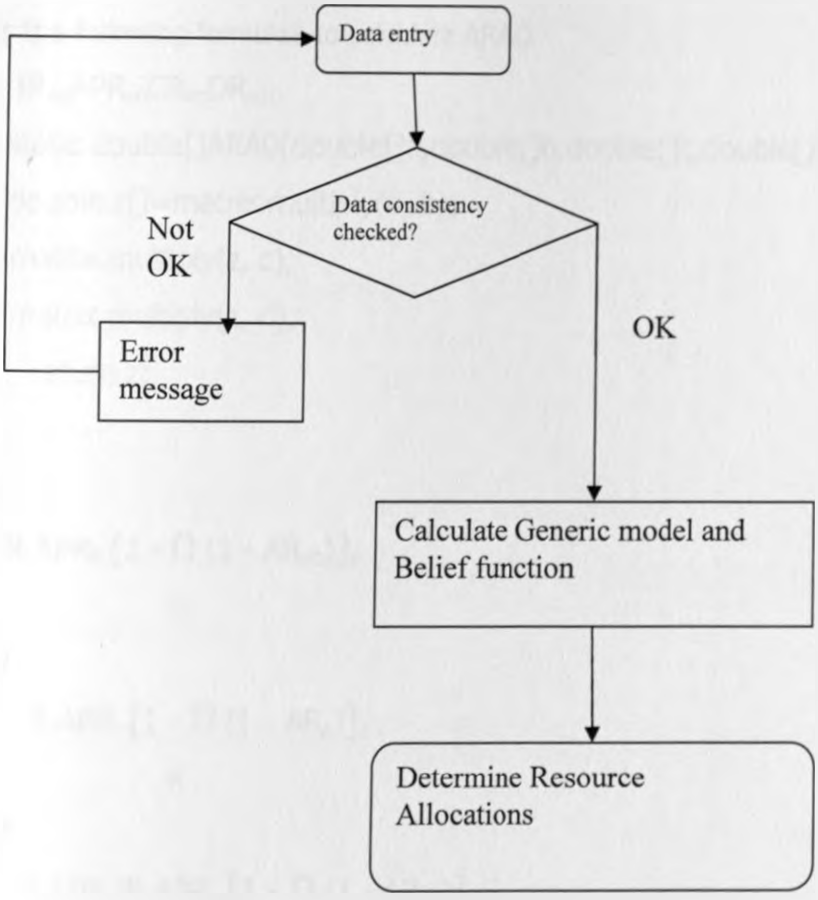

Figure 7: System process diagram

4.2.2 System Prototype Implementation

Class Matrix

The class manipulates the inputted data for easier processing with the following methods

Multiply()

The method takes several parameters as matrix and multiplies them

AR_{A0}()

It takes the following formulae to calculate ARAO

$AR_{AO}= IR_{AO}APR_{AO}CR_{AO}DR_{AO}$.

```
public static double[]ARA0(double[]a,double[]b,double[]c,double[]d)
 {     double z[]=matrix.multiply(a, b);
    z=matrix.multiply(z, c);
    z=matrix.multiply(z, d);
         return z;
 }
```

AR_A()

$$AR_A= IR_AAPR_A [1 - \prod_{O} (1 - AR_{AO})],$$

AR^{t}_{F}()

$$AR^{t}_{F} = IR_FAPR_F [1 - \prod_{A} (1 - AR_A)],$$

AR^{t}_{A} ()

$$AR^{t}_{A} = IR_FAPR_FIR_AAPR_A [1 - \prod_{O} (1 - AR_{AO})],$$

AR^{t}_{Ao} ()

$AR^{t}_{AO}= IR_FAPR_FIR_AAPR_AAR_{AO}$

Class Resources

The class determines resource allocation for both generic and belief functions according to the calculated AR^{t}_{F}

4.2.3 Testing the Framework

Prototype

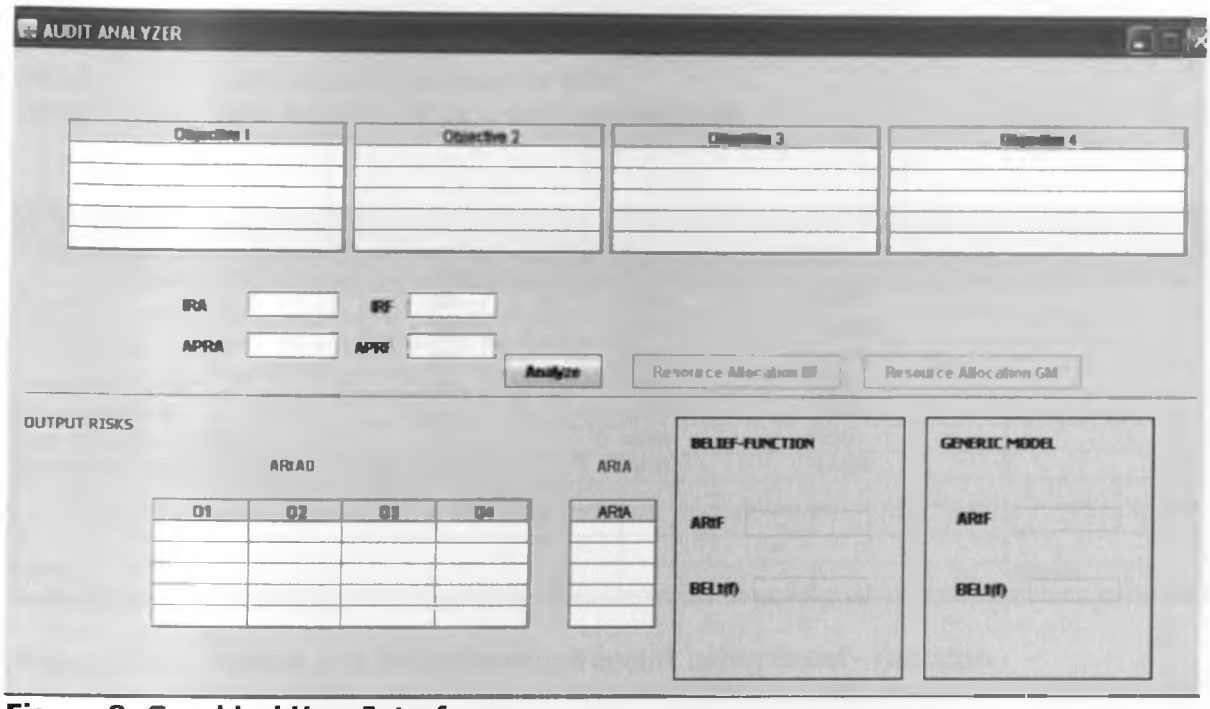

Figure 8: Graphical User Interface

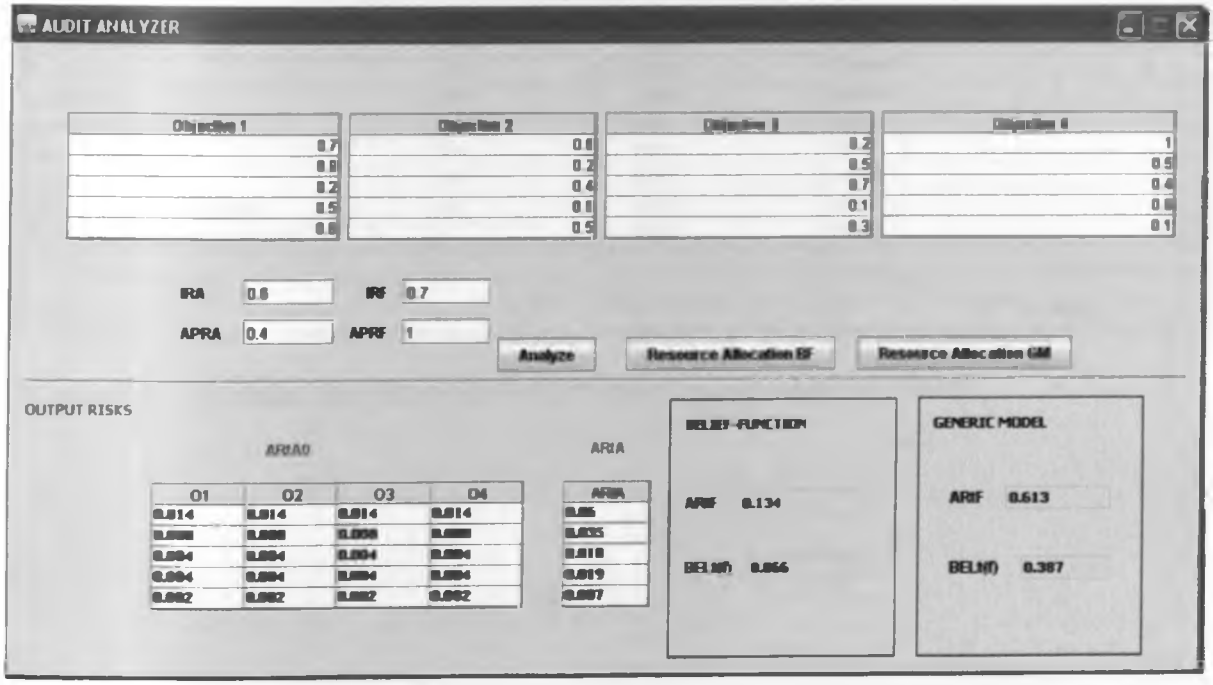

Figure 9: Results and Analysis

IRA	Inherent Risk at Accounts level
IRF	Inherent Risk at Financial Statement level
APRA	Analytical Procedure at Accounts level
APRF	Analytical Procedure at Financial Statement level
ARtAO	Total Audit risk at objective level
ARtA	Total Audit risk at Accounts level
ARtF	Total Audit risk at Financial Statement level

HUMAN RESOURCE	TIME REQUIREME...	RATE (ksh/hr)	SUB TOTAl(ksh)	GRAND TOTAl (ksh)
Auditor 1	80	1000	80000	
Auditor 2	80	1000	80000	
Auditor 3	80	800	64000	
Assistant Director	10	2000	20000	
Deputy Director	5	2500	12500	
Deputy Auditor General	2	4000	8000	
Controller & Auditor General	2	7000	14000	
TOTAL				278500

Figure 10: Human and financial requirement using Belief- Function

HUMAN RESOURCE	TIME REQUIREME...	RATE (ksh/hr)	SUB TOTAl(ksh)	GRAND TOTAl (ksh)
Senior Auditor	120	1500	180000	
Auditor 1	240	1000	240000	
Auditor 2	240	1000	240000	
Auditor 3	120	800	96000	
Assistant Director	20	2000	40000	
Deputy Director	20	2500	50000	
Deputy Auditor General	20	4000	40000	
Controller & Auditor General	5	7000	35000	
TOTAL				921000

Figure 11 : Human and financial requirement using Generic Model

5.0 RESULTS

5.1 Model Validation

For simplicity purposes suppose the balance sheet of the manufacturing firm mentioned in the Appendix A has five accounts and each account has four objectives. This model is based on one account (Account receivables) but the same is applicable to all other accounts. The auditor has gathered and evaluated all the relevant inherent factors at the level of the financial statement and the account and has assigned the following values for the respective plausibilities of material misstatement or risk: $IR_F = 0.7$ $IR_A = 0.6$ for all the accounts .The auditor has performed analytical procedure for various account and assigned a plausibility of material misstatement or risk of 0.4 to these procedure, but has not performed analytical procedure at the financial statement level. Thus $APR_A = 0.4$ for all accounts and $APR_F = 1$. These values result in total plausibility of error or risk at the financial statement level of 0.52, that is, $AR^t_F = 0.52$ (See table 1). This implies that, on the basis of evidence accumulated at the financial statement level and account level, the auditor finds that the financial statement is not materially misstated with a belief or assurance of 0.48. This information would help an auditor plan a more efficient audit than is possible with the generic model.

Table 1

Audit Risk model in Belief - Function Framework with IR_{AO}, APR_{AO}, CR_{A}, IR_{A}, APR_{A} and IR_{F} as inputs

INPUT RISKS

1 *Risk at the Audit Objective level*

Account	IR_{AO} Objectives				APR_{AO} Objectives				CR_{A} Objectives				DR_{A} Objectives			
	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
A_1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

2 *Risk at Accounts level*

Account	IR_A	APR_A
A_1	0.6	0.4
A_2	0.6	0.4
A_3	0.6	0.4
A_4	0.6	0.4
A_5	0.6	0.4

3 *Risk at Financial Statement level*

IR_F 0.7

APR_F 1.0

OUTPUT RISKS

1

Total Risk at the Audit Obective level (AR'_{AO}) (From equation 14)

Account	O_1	O_2	O_3	O_4
A_1	0.168	0.168	0.168	0.168
A_2	0.168	0.168	0.168	0.168
A_3	0.168	0.168	0.168	0.168
A_4	0.168	0.168	0.168	0.168
A_5	0.168	0.168	0.168	0.168

2

Total Risk at the Account Level (ARtA) (From equation 12)

0.168
0.168
0.168
0.168
0.168

3

Total Risk and Belief at the Financial Statement Level (From equation 8)

$AR'_F = 0.52$

$Bel'_F(f) = 0.48$

$AR'_{AO} = 0.7*1*0.6*0.4*1 = 0.168$ **(Eqn 7)**

$AR'_A = 0.7*1*0.6*0.4*[1-(1-1)^5] = 0.168$ **(Eqn 5)**

$AR'_F = 0.7*1[1-(1-0.24)^5] = 0.52$ **(Eqn 1)**

$Bel'_F(f) = 0.48$

AR'_F under generic model

$= 1*1[1-(1-1)^5] = 1$ **(Eqn 1)**

$Bel'_F(f) = 0$

5.2 Sensitivity Analyses

This type of analysis should aid an auditor in planning and conducting an audit more efficiently by providing an indication of the relative importance of a given piece of evidence on overall audit conclusions. If a test is found to have little impact, the auditor may consider whether it is sufficiently cost- effective or is needed to achieve a desired level of confidence. Through continued sensitivity analyses the auditor can plan a cost – effective set of tests.

Assume that the auditor proceeded to the detailed level and considered the following steps:

- Collected and evaluated inherent factors at audit objective level (IR_{AO})
- Performed analytical procedures at audit objective level if appropriate (APR_{AO})
- Studied and evaluated client's accounting systems and control procedures and performed test of transactions (CR_{AO})
- Performed direct test of balance (DR_{AO})

The results of the auditor's judgement are shown in terms of plausibilities of material misstatement or risks as inputs in tables 2 – 5.

Table 2

Audit Risk model in Belief – Function Framework with IR_{AO}, APR_{AO}, CR_{AO}, IR_A, APR_A, and IR_F as inputs

INPUT RISKS

1 *Risk at the Audit Objective level*

Account	IR_{AO} Objectives				APR_{AO} Objectives				CR_{AO} Objectives				DR_{AO} Objectives			
	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
A_1	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_2	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_3	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_4	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_5	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

2 *Risk at Accounts level*

Account	IR_A	APR_A
A_1	0.6	0.4
A_2	0.6	0.4
A_3	0.6	0.4
A_4	0.6	0.4
A_5	0.6	0.4

3 *Risk at Financial Statement level*

IR_F 0.7

APR_F 1.0

OUTPUT RISKS

Account	1 Total Risk at the Audit Obective level (AR^t_{AO}) (From equation 14) O_1	O_2	O_3	O_4	2 Total Risk at the Account Level (ARIA) (From equation 12)	3 Total Risk and Belief at the Financial Statement Level (From equation 8)
A_1	0.118	0.118	0.118	0.118	0.168	AR^t_F = 0.52
A_2	0.118	0.118	0.118	0.118	0.168	
A_3	0.118	0.118	0.118	0.118	0.168	$Bel^t_F(f)$ = 0.48
A_4	0.118	0.118	0.118	0.118	0.168	
A_5	0.118	0.118	0.118	0.118	0.168	

$AR^t_{AO} = 0.7*1*0.6*0.4*0.7 = 0.118$ **(Eqn 7)**

$AR^t_A = 0.7*1*0.6*0.4*[1-(1-0.7)^5] = 0.168$ **(Eqn 5)**

$AR^t_F = 0.7*1[1-(1-0.2394)^5] = 0.52$ **(Eqn 1)**

$Bel^t_F(f) = 0.48$

AR^t_F under generic model

$= 1*1[1-(1-0.9976)^5] = 1$ **(Eqn 1)**

$Bel^t_F(f) = 0$

In table 2, we see that there is almost no impact of inherent factors at the audit objective level on AR^t_F and AR^t_A. However, AR^t_{AO} reduces from 16.8% to 11.8%. Consideration of analytical procedures at the audit objective level reduces AR^t_F to 50% AR^t_A to 15.7% and AR^t_{AO} to 7.1 % as shown in table 3. When accounting systems and control procedures are included in the model, the total plausibility of material misstatement (i.e, the total risk at varies levels) is further reduced. AR^t_F = 28%, AR^t_A varies between 6 and 10.1 %, and AR^t_{AO} between 1.4 and 2.8 % (See table 4).

Table 3

Audit Risk model in Belief - Function Framework with IR_{AO}, APR_{AO}, CR_{AO}, IR_A, APR_A, and IR_F as inputs

INPUT RISKS

1 *Risk at the Audit Objective level*

	IR_{AO} Objectives				APR_{AO} Objectives				CR_{AO} Objectives				DR_{AO} Objectives			
Account	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
A_1	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_2	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_3	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_4	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A_5	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

2 *Risk at Accounts level*

Account	IR_A	APR_A
A_1	0.6	0.4
A_2	0.6	0.4
A_3	0.6	0.4
A_4	0.6	0.4
A_5	0.6	0.4

3 *Risk at Financial Statement level*

IR_F 0.7

APR_F 1.0

OUTPUT RISKS

	1 Total Risk at the Audit Obective level (AR^t_{AO}) (From equation 14)				2 Total Risk at the Account Level (ARtA) (From equation 12)	3 Total Risk and Belief at the Financial Statement Level (From equation 8)
Account	O_1	O_2	O_3	O_4		
A_1	0.071	0.071	0.071	0.071	0.157	AR^t_F = 0.50
A_2	0.071	0.071	0.071	0.071	0.157	
A_3	0.071	0.071	0.071	0.071	0.157	$Bel^t_F(f)$ = 0.50
A_4	0.071	0.071	0.071	0.071	0.157	
A_5	0.071	0.071	0.071	0.071	0.157	

$AR^t_{AO} = 0.7*1*0.6*0.4*0.42 = 0.0.071$ (Eqn 7)

$AR^t_A = 0.7*1*0.6*0.4*[1-(1-0.42)^5] = 0.157$ (Eqn 5)

$AR^t_F = 0.7*1[1-(1-0.2394)^5] = 0.50$ (Eqn 1)

$Bel^t_F(f) = 0.50$

AR^t_F under generic model

$= 1*1[1-(1-0.9344)^5] = 1$ (Eqn 1)

$Bel^t_F(f) = 0$

Table 4

Audit Risk model in Belief - Function Framework with IR_{AO}, APR_{AO}, CR_{AO}, IR_A, APR_A, and IR_F as inputs

INPUT RISKS

1 *Risk at the Audit Objective level*

	IR_{AO} Objectives				APR_{AO} Objectives				CR_{AO} Objectives				DR_{AO} Objectives			
Account	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
A_1	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	1.0	1.0	1.0	1.0
A_2	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	1.0	1.0	1.0	1.0
A_3	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.4	0.4	0.4	0.4	1.0	1.0	1.0	1.0
A_4	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	1.0	1.0	1.0	1.0
A_5	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	1.0	1.0	1.0	1.0

2 *Risk at Accounts level*

Account	IR_A	APR_A
A_1	0.6	0.4
A_2	0.6	0.4
A_3	0.6	0.4
A_4	0.6	0.4
A_5	0.6	0.4

3 *Risk at Financial Statement level*

IR_F 0.7

APR_F 1.0

OUTPUT RISKS

	1 Total Risk at the Audit Objective level (AR'_{AO}) (From equation 14)				2 Total Risk at the Account Level (ARtA) (From equation 12)	3 Total Risk and Belief at the Financial Statement Level (From equation 8)
Account	O_1	O_2	O_3	O_4		
A_1	0.071	0.014	0.014	0.014	0.060	AR'_F = 0.28
A_2	0.071	0.014	0.014	0.014	0.060	$Bel'_F(f)$ = 0.72
A_3	0.071	0.028	0.028	0.028	0.101	
A_4	0.071	0.014	0.014	0.014	0.060	
A_5	0.071	0.014	0.014	0.014	0.060	

$AR^t_{AO} = 0.7*1*0.6*0.4*0.084 = 0.0.014$ (Eqn 7)

$AR^t_{AO} = 0.7*1*0.6*0.4*0.168 = 0.0.028$ (Eqn 7)

$AR^t_A = 0.7*1*0.6*0.4*[1-(1-0.084)^5] = 0.060$ (Eqn 5)

$AR^t_A = 0.7*1*0.6*0.4*[1-(1-0.168)^5] = 0.101$ (Eqn 5)

$AR^t_F = 0.7*1[1-(1-0.2394)^5] = 0.28$ (Eqn 1)

$Bel^t_F(f) = 0.72$

AR^t_F under generic model

$= 1*1[1-(1-0.414)^5] = 0.931$ (Eqn 1)

$Bel^t_F(f) = 0.069$

At this stage the auditor decides about the extent, timing and nature of the detailed test of balance so as to obtain the overall plausibility of material misstatement at 0.05 or an overall assurance that financial statements are not materially misstated of 0.95. The risks at the other levels vary as follows: AR^t_A varies between 1.0 % and 1.4 %, and AR^t_{AO} varies between 0.2% and 0.3 % (see table 5)

Table 5

Audit Risk model in Belief - Function Framework with IR_{AO}, APR_{AO}, CR_{AO}, IR_A, APR_A and IR_F as inputs

INPUT RISKS

1 *Risk at the Audit Objective level*

	IR_{AO} Objectives				APR_{AO} Objectives				CR_{AO} Objectives				DR_{AO} Objectives			
Account	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
A_1	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15
A_2	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15
A_3	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.4	0.4	0.4	0.4	0.10	0.10	0.10	0.10
A_4	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15
A_5	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15

2 *Risk at Accounts level*

Account	IR_A	APR_A
A_1	0.6	0.4
A_2	0.6	0.4
A_3	0.6	0.4
A_4	0.6	0.4
A_5	0.6	0.4

3 *Risk at Financial Statement level*

IR_F 0.7

APR_F 1.0

OUTPUT RISKS

1

Total Risk at the Audit Objective level (AR^t_{AO}) (From equation 14)

Account	O_1	O_2	O_3	O_4
A_1	0.002	0.002	0.002	0.002
A_2	0.002	0.002	0.002	0.002
A_3	0.003	0.003	0.003	0.003
A_4	0.002	0.002	0.002	0.002
A_5	0.002	0.002	0.002	0.002

2

Total Risk at the Account Level (ARtA) (From equation 12)

0.010
0.010
0.014
0.010
0.010

3

Total Risk and Belief at the Financial Statement Level (From equation 8)

$AR^t_F = 0.05$

$Bel^t_F(f) = 0.95$

It is important to note that consideration of the structure of evidence in our plausibility models makes the audit process more efficient. The auditor will plan less extensive tests at audit objective level when the evidence at the financial statement level and account level is positive. As seen in table 6, when the evidence at the account level and the financial statement level is not included in the plausibility model (as in the generic model) the total plausibility of material misstatement or the total audit risk at the financial statement level is high (AR^t_F=29 %) or the total belief that the financial statement is not materially misstated is low ($\mathbf{Bel}^t_F(f)$ = 0.71).

Table 6

Audit Risk model in Belief – Function Framework with [illegible]

INPUT RISKS

1 *Risk at the Audit Objective level*

Account	IR_{AO} Objectives				APR_{AO} Objectives				CR_{AO} Objectives				DR_{AO} Objectives			
	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
A_1	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15
A_2	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15
A_3	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.4	0.4	0.4	0.4	0.10	0.10	0.10	0.10
A_4	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15
A_5	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.15

2 *Risk at Accounts level*

Account	IR_A	APR_A
A_1	1.0	1.0
A_2	1.0	1.0
A_3	1.0	1.0
A_4	1.0	1.0
A_5	1.0	1.0

3 *Risk at Financial Statement level*

IR_F 1.0

APR_F 1.0

OUTPUT RISKS

1 Total Risk at the Audit Objective level (AR'_{AO}) (From equation 14)

Account	O_1	O_2	O_3	O_4
A_1	0.013	0.013	0.013	0.013
A_2	0.013	0.013	0.013	0.013
A_3	0.017	0.017	0.017	0.017
A_4	0.013	0.013	0.013	0.013
A_5	0.013	0.013	0.013	0.013

2 Total Risk at the Account Level (ARtA) (From equation 12)

0.061
0.061
0.061
0.061
0.061

3 Total Risk and Belief at the Financial Statement Level (From equation 8)

$AR'_F = 0.29$

$Bel'_F(f) = 0.71$

Thus without an explicit treatment of the evidence at the financial statement level and the account level , the auditor will always underestimate the overall assurance and will collect more evidence than necessary at the detail level as shown below:

Inputs								TOTAL AUDIT RISK OUTPUTS			
								Belief Function		Generic Model	
IR_{AO}	APR_{AO}	CR_{AO}	DR_{AO}	IR_A	APR_A	IR_F	APR_F	AR'_F	$Bel'_F(f)$	AR'_g	
1	1	1	1	0.6	0.4	0.7	1	0.52	0.48	1.00	
0.7	1	1	1	0.6	0.4	0.7	1	0.52	0.48	1.00	
0.7	0.6	1	1	0.6	0.4	0.7	1	0.50	0.50	1.00	
0.7	0.6	0.2	1	0.6	0.4	0.7	1	0.28	0.72	0.93	
0.7	0.6	0.2	0.15	0.6	0.4	0.7	1	0.05	0.95	0.29	

Generic Model result in high cost audits because of overstated audit risk as detailed in appendix D and summarized below:

								TOTAL AUDIT RISK OUTPUTS				MONETARY GAINS		
								Belief Function		Generic Model		Belief Function	Generic Model	Gain in Ksh
IR_{AO}	APR_{AO}	CR_{AO}	DR_{AO}	IR_A	APR_A	IR_F	APR_F	AR'_F	$Bel'_F(f)$	AR'_g	$Bel'_F(f)$	Cost in Ksh	Cost in Ksh	
1	1	1	1	0.6	0.4	0.7	1	0.52	0.48	1.00		921,000.00	1,101,000.00	180,000.00
0.7	1	1	1	0.6	0.4	0.7	1	0.52	0.48	1.00		921,000.00	1,101,000.00	180,000.00
0.7	0.6	1	1	0.6	0.4	0.7	1	0.50	0.50	1.00		616,000.00	1,101,000.00	485,000.00
0.7	0.6	0.2	1	0.6	0.4	0.7	1	0.28	0.72	0.93		616,000.00	1,101,000.00	485,000.00
0.7	0.6	0.2	0.15	0.6	0.4	0.7	1	0.05	0.95	0.29		278,500.00	616,000.00	337,500.00

5.3 Interpreting the Results

Thus without an explicit treatment of the evidence at the financial statement level and the account level , the auditor will always underestimate the overall assurance and will collect more evidence than necessary resulting in high cost audits and inefficient utilization of resources

5.4 Benefits of the System

The project has the following benefits:

- Efficient utilization of resources eg human and time
- Timely and accurate audit reports
- Good decision making based on the accurate financial statements
- Reduced quality control procedures such as the appointment of an additional member to the audit team

5.5 Users Feedback about the Project.

A feedback questionnaire (Appendix E) was prepared to get the views of other auditing professionals about the project. Fifteen questionnaires were issued of which eleven responded. The entire respondent concurred with the project findings with a special emphasis on the saving in terms of human, financial and time resources. They specifically concurred with the findings that they higher the risk the higher the cost of audit. In this regard an overstated audit risk would lead to unnecessary cost as is the case of generic model of audit risk assessment.

Over 70% of the respondents expressed their appreciation to the project findings that linked the audit risk to human and financial requirements. They recommended project to be developed further because it could be the beginning of fully automated audit process. It also emerged that belief – function model of evaluating audit risk is not applied in KENAO despite its benefits over the generic model. All the respondents recommended the project to be developed for application in KENAO.

5.6 Limitations of the Models

We must emphasize that there are strong limitations on the applicability of the formulas we have derived, limitations that are shared by the SAS No. 47 formula and existing Bayesian formulas.

First, this research was an exploratory study to examine the feasibility of a belief function approach to audit planning and evidence evaluation. As such, while the initial findings reported here suggest this approach is promising as a valuable audit tool, there are several fruitful avenues for future research. To simplify the data accumulation and analyses, the model examined evidential evaluation for only a single account and for two important assertions. Further, it is assumed that only two accounts are present. To enhance realism further work is needed to expand this analysis to consider multiple accounts. Further since we have considered only binary variables, we have distinguished only whether an account is materially misstated or not. We have not distinguished between material misstatement due to overstatement or understatement. This limitation will make the audit process less efficient. For example, if there are two accounts, one materially overstated and the other materially understated by the same amount, and the

auditor feels that the combination of the two accounts is fairly stated because of the offsetting errors, the present approach will suggest that the combination is materially misstated and hence lead to inefficiency.

Second, we have not considered immaterial errors in individual accounts that might add up to a material error in the whole financial statement. This will also make the audit less efficient.

Third, we have assumed that each account or audit objective is equally important. This assumption may make the audit process less efficient because the auditor may still have to obtain a high level of assurance for an unimportant audit objective.

We have already mentioned other limitations due to our simplifying assumptions. We considered only a tree-type evidential structure, and only affirmative evidence is considered. As we have already explained, it may be feasible to derive formulas with these assumptions relaxed to some extent, but an algorithmic approach to the more complex case is probably preferable.

When discussing the increased efficiency possible with more accurate representation of the structure of the audit evidence, we must always bear in mind that the decrease in audit effort that is implied by plans based on such structure can decrease audit effectiveness if the inputs to the model cannot be estimated accurately by auditors who employ it.

6.0 CONCLUSION

The project has presented an audit planning using a belief function framework. A general audit planning model was developed (Figure 6) that presents a general evidential structure that KENAO can use to link assertions to audit evidence in testing accounts receivables.

A questionnaire in form of an audit plan was conducted and beliefs (audit evidence) elicited for an actual audit of a manufacturing client. Assessments of the strength of evidence were provided by the auditor in charge of the audit and the structure of the model validated by the same auditor. Thus without an explicit treatment of the evidence at the financial statement level and the account level , the auditor will always underestimate the overall assurance and will collect more evidence than necessary resulting in high cost audits and inefficient utilization of resources.

The project, despite its applicability limitations, has shown that audit evidence considered at the three levels will result in efficient utilization of resources, timely and accurate audit reports, good decision making and reduced quality control procedures.

It is therefore possible to develop a computerized risk assessment for all items of financial statement. This study present a framework for a risk adjusted computerized risks assessment for KENAO using Belief – Function. More research is still being undertaken in this area because the model has some applicability limitations.

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8.0 APPENDICES

8.1 APPENDIX A

Completed Risk Assessment Questionnaire

I. General Client Information

1. Engagement Code: **A**
2. Client Industry __**Manufacturing**__
3. Years this client been audited by KENAO ___ **10+** ___
4. Fee Basis: ___**Fixed Fee**___

5. Client Financial data in thousands of Kenya Shillings (Ksh 000's)

Total assets Ksh 4, 809,365
Total revenues Ksh 6, 030,117
Net income (loss) Ksh 389,094
Accounts receivable balance Ksh 815,221
Current liabilities Ksh 899,759
Long-term liabilities Ksh 321,324

6. Total planned auditing time on engagement, including staff and senior managers

hours: 1,000 hours

7. Indicate CHANGES in the following personnel on the engagement

In-charge _ **No Change**__
Manager _ **Change**_ ___
Partner _ **No Change** __

8. The client's shares are: **Public Company**

9. Indicate whether the company had a material (i.e., greater than average) bonus incentive plan for management based on reported profits. ___**NO**__

II. Client Situational Factors

Below are a series of questions on the general environment/conditions surrounding the audit engagements this year and in prior years. Questions are

presented on a continuous scale; YOU MAY PLACE A CHECK MARK AT ANY PLACE ALONG THE SCALE.

10. Rate the level of knowledge of the entity's accounting personnel (i.e., managers and staff) in terms of their awareness and understanding of accounting principles and practices and how to apply them. Consider college degrees held, training courses attended, and your observations of the personnel.

	Extremely high knowledge level						Extremely low knowledge level
Current year	|----	----	----	--X--	----	----	----|

11. Rate the accounting personnel's general attitude in accomplishing their responsibilities (managers and staff.)

	Extremely Conscientious						Unconscientious
Current year	|----	--X--	----	----	----	----	----|

12. To what degree did the entity's financial information system(s) change in the fiscal year in terms of input, output, or degree of computerization?

	Significant change						No Change
Current year	|----	----	----	----	----	--X--	|

13. To what degree is (are) the entity's financial information system (s) computerized?

	Completely Computerized						Completely manual
Current year	|--	X--	----	----	----	----	----|

14. Rate the overall level of general controls, including potential for management override. Consider factors such as organizational structure, documentation policies, existence of budgets and comparison of budgets to actual results, and existence of an internal audit department.

	Extremely strong general controls						Extremely weak general controls
Current year	|----	----	--X----	----	----	----	----|

15. Rate management's (i.e., CEO, CFO, and other operating officers) aggressiveness in committing the entity to high risk ventures or projects.

	Extremely aggressive						Extremely conservative
Current year						X	

16. Evaluate the extent of high level management turnover (i.e., CEO and other key operating officers).

	Extremely high turnover						No turnover
Current year						X	

Questions specifically related to Accounts Receivable and Related Allowance for Collectibles

20. Rate the degree to which judgment (including estimates) was required in arriving at the entries to the accounts receivable account.

	Extreme judgment was required						Little or no judgment was required
Current year						X	

21. Rate the degree to which judgment (including estimates) was required in arriving at the entries to the allowance for uncollectible accounts.

	Extreme judgment was required						Little or no judgment was required
Current year		X					

22. Rate the degree of complexity underlying the entries made to the accounts receivable and related allowance for collectibles. For example, summarizing cash receipts usually is not complex, whereas calculating the liability and expense related to income taxes is often highly complex.

An extremely high level of complexity underlying the entries the entries						Little or no complexity underlying

Current year |----|----|----|----|----|----|--X--|

23. Rate the relative number of unusual transactions (including related party transactions) included in the accounts receivable and related allowance for uncollectibles as compared to similar clients in the industry.

A significant number of unusual transactions	Very few or no unusual transactions

Current year |----|----|----|----|----|----|--X--|

24. Indicate the total number of audit differences found affecting the Accounts Receivable and related Allowance for Uncollectibles accounts:

	Number of Differences	Number of Differences Equaling or Exceeding Planning Materiality
Current year	___0__	__0___

25. Indicate the level of assessed Inherent risk of the likelihood for a material error due to **Existence** problems: ***Low Risk***

26. Indicate the level of assessed Inherent risk of the likelihood for a material error due to **Valuation** problems: ***Low risk***

27. Indicate the level of assessed Inherent risk of the likelihood for a material error due to **Completeness** problems: ***Low risk***

III. Planned Substantive Audit Programs

The focus of Section 2 of the questionnaire is to obtain information on the planned substantive procedures chosen in the Revenue & Receipts Cycle). Also, the extent of testing (planned hours) among procedures is investigated.

CONTROL RISK

28. The level of control risk for the Revenue and Receipts cycle after tests of controls:

Low Risk	Moderate Risk	Maximum Risk	Controls not Relied on

Current year |----|----|--X--|----|----|----|---| _____

29. The level of control risk for the Revenue & Receipts cycle before tests of controls, if any were performed:

	Low Risk	Moderate Risk	Maximum Risk	Controls not Relied on
Current year	|----|----|--X--|----|----|----|---|		_____

8.2 APPENDIX B

ACCOUNTS RECEIVABLES AUDIT PROGRAM

1. **Audit objectives**

i. **Existence**
To ascertain whether recorded receivables balances represent amounts due from the indicated receivables at the period end.

ii. **Ownership**
To ascertain that receivables were properly owned by the client and that all lien, security interests and other encumbrances have been properly identified.

iii. **Completeness**
To ascertain that all receivables attributable to the client at the period end have been recorded.

iv. **Valuation**
To ascertain that receivables have been accurately stated and valued in accordance with the client's accounting policies and applied on a consistent basis.

v. **Presentation and Disclosure**
To ascertain all the receivables have been disclosed in accordance with relevant accounting framework.

2. **Error Conditions**

i. **Existence**
- Receipts of debt settlements not recorded.
- Credits due to customers and adjustments to receivables not recorded.

ii. **Ownership**

Receivables not properly or fully owned by the client.

iii. **Completeness**

- Goods dispatched or services rendered without an invoice being raised.
- Sales invoices or other claim documents not been recorded.
- Invalid receipts/credits recorded and vice versa
- Transactions not correctly posted.

iv. **Valuation**

- Invoices or other claim documents recorded at incorrect amounts.
- Errors in preparation of credit notes and other adjustments.

- Receipts recorded at incorrect amounts.
- Inadequate provision for bad and doubtful debts.

v. Presentation and Disclosure

- Entries in respect of trade receivables posted to incorrect ledger accounts.
- Presentation and disclosure of receivables not complying with the relevant accounting framework.

3. Substantive Tests

	Method of sampling	Sample size	WP Ref.	Auditor's initial's	Date
i. Existence • Obtain from the receivables direct confirmation of period end balances and agree balances to the client's records • Review the general ledger and confirm posting from source documents. (*See circularization procedures).* **i. Ownership** Review minutes of Senior Management/Board meetings, loan agreements and similar documentation for evidence of restrictions on loss of ownership of receivables. **ii. Completeness** a. Review management's procedures designed to ensure that all goods dispatched or services rendered are accurately recorded on dispatch notes which should be accounted for completely. b. Select an appropriate sample of sales/services orders and confirm that the subsequent deliveries of goods and services have been accurately recorded. c. Where there are any unfulfilled orders which are long outstanding, ascertain whether dispatches may have been					

made without being recorded. d. Review any correspondence disputes with customers for evidence of incomplete or incorrect dispatches or invoicing. e. Perform cut-off tests on a sample basis. f. Select a sample of cash/cheques received and confirm that they have been properly recorded in the cashbook and the general ledger. g. Select a sample of credit notes issued during the period, and confirm validity and authorization through inspection of supporting documentation. Confirm that the credit notes have been posted to the appropriate ledger account h. Review correspondence with customers for any disputes over amounts owing and claims of unreflected payments in statements. i. Review the receivables accounts in the general ledger for unusual items which may have been classified wrongly as receivables. j. Check for credit balances in the sales ledger and ensure that the major balances are supported. k. Review periodic and year end bank reconciliations for evidence of teeming and lading of receipts or similar invalid credit entries relating to receivables. **iii. Valuation** a. Review the receivables age analysis and ensure that adequate provision, whether specific or general has been made. b. Review the client's bad debt history					

over the previous years and in the prevailing business climate, consider the likelihood of changes to the level of provision for bad debts. c. Assess the adequacy of provisions made for uncollectible amounts, discounts, returns, warranties e.t.c. d. Review the results of the receivables circularization to ascertain whether what has been recorded is actually owed. e. Re-perform the translation of any amounts denominated in foreign currencies, checking the rates used to an authoritative source. iv. **Presentation and Disclosure** a. Ensure that there is an adequate basis for proper disclosure of receivables in the accounts. b. Ensure that the total of credit balances in receivables is transferred to payables in the final accounts. c. Review the accounts and determine whether receivables are properly disclosed on a consistent basis. Ensure that individual receivables agree to the receivables control account.					
v. Debtor Circularization Procedures: i. Select a sample of receivables accounts at the year end. ii. Arrange for the sample to be given to the client for the necessary details to be inserted in the circularization letters. iii. Supervise the enveloping, sealing and posting of the confirmation requests and ensure that all replies are sent directly toKENAO. iv. Where no response is received within reasonable time, contact the recipient					

of the request to elicit a response. v. If a response is still not received, perform and document an alternative audit procedure. vi. If management declines to seek external confirmation, consider and document whether there are valid grounds and obtain evidence to support the validity of their refusal. vii. Where circularization is not done, document the reasons and the alternative procedures carried out. viii. Complete a Summary Control Schedule for the circularized receivables.					

RECEIVABLES CIRCULARIZATION

Selecting the sample

The types of accounts that the auditor must include in his sample would be:

a) All large balances that are above the established materiality level for receivables. This is because a receivables circularization is a substantive procedure and therefore the more the receivables balances the auditor can verify the more assured he will be that the receivables balances are fairly stated.

b) Credit balances: Normally receivables balances should be debit balances. When the system produces credit balances then they might not be genuine credit balances.

c) Nil or small balances at the circularization date for accounts that are normally very active.

d) Customers who have exceeded their credit limits yet no follow-up has been undertaken.

e) Accounts with related parties for instance with directors and other connected organizations.

Based on the above information the auditors assign the following value for respective plausibility of material misstatement or risk:

IR_F=0.7, IR_A=0.6, APR_A=0.4, APR_F=1

8.3 APPENDIX C

CHECKLIST OF ENVIRONMENTAL INHERENT AND CONTROL RISK FACTORS

A MANAGEMENT PHILOSOPHY AND OPERATING STYLE

- Management and operating decisions dominated by one or few individuals
- Attitude of management to internal control structure
- Likelihood of management override
- Management emphasis on meeting budget, profit and other financial and operating goals
- Management emphasis on safeguarding of assets (eg security of physical assets)
- Management experience and knowledge needed to operate business
- Rate of management turnover
- Management's approach (aggressive/conservative attitude) to taking and monitoring business risks
- Management's financial reporting philosophy (may be characterized for example as maximizing reported profits, maintaining earnings level, maintaining net asset value, maintaining share price, minimizing taxable income or accurately reflecting financial results)
- Quality of accounting policies selected
- Management willingness to adjust financial statements for misstatements
- Management attitude towards regulatory compliance
- Incidence of transactions entered into for no apparent business purpose
- Extent of ongoing consultation with auditors on accounting issues
- Management relationship with other advisers (rate of turnover)
- Extent and nature of transactions or arrangements with related parties

B OPERATING STRUCTURE AND METHODS OF CONTROL

- Clearly defined organization, lines of authority, responsibility and reporting
- Frequency of changes in organizational structure
- Policies for authorization of transactions defined at adequately senior levels
- Mechanisms for monitoring adherence to/reporting departures from company policies

- Adequacy of control over decentralized operations
- Degree of management's involvement in day to day operations
- Past experience with operation of controls
- Effectiveness of the board of directors and, if appropriate, the audit committee (or other equivalent body) in overseeing financial reporting
- How the board fulfills its fiduciary and accountability responsibilities
- Whether the client has policies regarding appropriate business relationships, conflicts of interest, and codes of conduct
- Management objectives (financial and operating goals) clearly defined, communicated, and monitored
- Management's ability to supervise effectively overall company activities
- The methods used in exercising direct control over company activities and those given authority to carry out those activities
- Management's use of appropriate internal and external data to control and run the business and for other aspects of decision-making, planning and evaluating performance (eg budgets, variance reports, operating statistics regarding sales, margins and employee numbers, production data such as volume or tonnage statistics and data from specially commissioned market research and trade and industry journals)
- Adequacy of mechanisms for identifying, reporting and investigating variances from planned performance
- Quality of operating information systems
- The organizational structure of data processing activities
- Policies for developing and modifying accounting systems and control procedure, including the development, modification, and use of any related computer programs and data files
- Existence, independence and effective use of an internal audit function
- Policies and procedures for hiring, training, evaluating, promoting and compensating employees and providing them with the necessary resources to discharge their assigned responsibilities
- Appropriate policies and procedures for developing new uses, and modifying existing uses, of information technology.

C THE ACCOUNTING ENVIRONMENT

- Competence (background, training, and experience) of accounting personnel
- Attitude and morale of accounting personnel
- Rate of turnover of accounting personnel
- Adequacy of both human resources and data processing resources in relation to the workload
- Previous audit experience with accounting personnel
- Previous audit experience with late accounting adjustments and reasons therefor
- Time pressure imposed by financial reporting timetable
- Likelihood of material transactions or adjustments near the financial year-end
- Frequency of contentious accounting issues in the past and new problems expected in the current year
- Overall degree-of-day to day supervision of accounting personnel
- Extent of judgment and estimation involved in accounting routines
- Adequacy of policies and procedures for developing accounting estimates
- Likelihood of biases in accounting estimates
- Adequacy of procedures for developing and modifying accounting systems
- Rate of change in accounting systems and procedures
- In a computerized system
  - Degree of integration of systems
  - Use of package (standard, purchased) systems or in-house developed systems
  - Reputation of package or external data-processing bureau.

D EXTERNAL INFULENCES

- External or compliance requirements imposed by external regulatory bodies
- Active monitoring or review by regulators, insurers, lenders, customers, suppliers or other third parties
- Requirements and needs of investors in the company
- Spread of holdings of equity interests beyond those of management and employees
- Likelihood of sale of equity interests by significant existing holders

- Likelihood of public offering of shares
- Industry in which client operates (profitability, maturity, growth, competition, degree of specification, stability, influence of technology and other factors)
- History of litigation against client or management, including disputes with, or special investigation by, the tax authorities, and any current or expected litigation
- Liquidity and profitability of client relative to industry norms
- Liquidity and profitability of client relative to previous years
- Relationships with bankers and needs for additional funds.

E **ADDITIONAL CONSIDERATIONS BY SPECIFIC AREA**

- Past audit experience with the area
- Extent of use of accounting estimates/judgment in the area
- Adequacy of policies and procedures for developing accounting estimates in the area
- Complexity of accounting issues in the area
- Size and volume of transactions in the area
- Complexity of accounting calculations involved
- Frequency or significance of difficult-to-audit transactions in the area
- Susceptibility of related assets to misappropriation
- Quality of specific policies

8.4 APPENDIX D

Risk levels	Human resource requirements	Time requirements in Hrs	Rate in Ksh per Hr	Sub - Total in Ksh	Grand Total in Ksh
0.7 - 1.00	**Audit Team**				
	Principal Auditor	120	1,500.00	180,000.00	
	Senior Auditor	120	1,500.00	180,000.00	
	Auditor I	240	1,000.00	240,000.00	
	Auditor II	240	1,000.00	240,000.00	
	Auditor III	120	800.00	96,000.00	
	Reviewers				
	Assistant Director	20	2,000.00	40,000.00	
	Deputy Director	20	2,500.00	50,000.00	
	Deputy Auditor General	10	4,000.00	40,000.00	
	Controller & Auditor General	5	7,000.00	35,000.00	
				1,101,000.00	**1,101,000.00**
0.5 - 0.7	**Audit Team**				
	Senior Auditor	120	1,500.00	180,000.00	
	Auditor I	240	1,000.00	240,000.00	
	Auditor II	240	1,000.00	240,000.00	
	Auditor III	120	800.00	96,000.00	
	Reviewers				
	Assistant Director	20	2,000.00	40,000.00	
	Deputy Director	20	2,500.00	50,000.00	
	Deputy Auditor General	10	4,000.00	40,000.00	
	Controller & Auditor General	5	7,000.00	35,000.00	
				921,000.00	**921,000.00**
0.2 -0.5	**Audit Team**				
	Senior Auditor	120	1,500.00	180,000.00	
	Auditor I	120	1,000.00	120,000.00	
	Auditor II	120	1,000.00	120,000.00	
	Auditor III	120	800.00	96,000.00	
	Reviewers				
	Assistant Director	10	2,000.00	20,000.00	
	Deputy Director	10	2,500.00	25,000.00	
	Deputy Auditor General	5	4,000.00	20,000.00	
	Controller & Auditor General	5	7,000.00	35,000.00	
				616,000.00	**616,000.00**
0 - 0.2	**Audit Team**				
	Auditor I	80	1,000.00	80,000.00	
	Auditor II	80	1,000.00	80,000.00	

	Auditor III	80	800.00	64,000.00	
	Reviewers				
	Assistant Director	10	2,000.00	20,000.00	
	Deputy Director	5	2,500.00	12,500.00	
	Deputy Auditor General	2	4,000.00	8,000.00	
	Controller & Auditor General	2	7,000.00	14,000.00	
				278,500.00	**278,500.00**

8.5 APPENDIX E

AUDIT RISK ASSESMENT FRAMEWORK USING BELIEF – FUNCTION MODEL FOR KENYA NATIONAL AUDIT OFFICE (KENAO).

Users Feedback Questionnaire

The following is a questionnaire in relation to my MSC project entitled **AUDIT RISK ASSESMENT FRAMEWORK USING BELIEF – FUNCTION MODEL FOR KENYA NATIONAL AUDIT OFFICE (KENAO).** The information obtained will be treated with confidentiality and will be used for the purpose of presenting the project and not for any other purpose whatsoever.

1. What is your profession? .....
2. List the audit risk formulae you know? .....
   .....
   .....
3. Which formula does your organization use in audit risk assessment?
   .....
4. How do you compare the formula used in your organization with the belief – function formula as demonstrated in this project?.....
   .....
   .....
   .....
   .....
   .....
5. Would you recommend belief – function formula for audit assessment in your organization?.....
   Give reasons

   .....
   .....

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6. Is there any other general comment regarding the project?.....

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.....

.....

Name (Optional).....

Date:.....

8.6 APPENDIX F

Definition of Terms

Financial Statements

This is a combination of the following components;

- Balance sheet
- An income statement
- A statement of change in equity
- Cash flow statement
- Notes, comprising a summary of significant accounting policies and other explanatory notes.

Audit Opinion

This is the report by auditor at the end of each audit. The auditor should evaluate the conclusions drawn from the audit evidence obtained as a basis for forming an opinion on the financial statements. Types of audit opinion include;

- Unqualified report
- Qualified report
- Adverse report
- Disclaimer report

Audit Risk

This is the risk that the auditor expresses an inappropriate audit opinion when the financial statements are materially misstated. Audit risk has three components; Inherent risk, Control risk and detection risk. Professional judgment should be applied to assess audit risk and design audit procedures that will ensure that the audit risk is reduced to an acceptably low level.

Audit Objective

The overall audit objective is enable the auditor to express an opinion whether the financial statements are prepared in all material respects, in accordance with an identified financial reporting framework. Other audit objectives include testing or assessing the reasonableness of management assertions

Management assertions

These are declarations made by management about information contained in the financial statements. They include

- Existence
- Ownership ()
- Completeness
- Valuation
- Presentation and Disclosure
- Occurrence
- Measurements

Dempster – Shafer Theory

This is a mathematical theory of evidence. It allows one to combine evidence from different sources and at a degree of belief (represented by a belief function) that takes into accouint all the available evidence. The theory was developed by Arthur P. Dempster and Glenn Shafer.