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Shares Performance Evaluation in Kenya: A Decision Support System Approach

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DEDICATION

I dedicate this project to my Mum and Dad.

ABSTRACT

The share market is a complex and tedious investment avenue. It takes diligence, financial muscle, time and high level of dedication to wade through the murky waters of the share market and fully benefit from the same. This has resulted in minimal participation of individual and small scale institutions. Currently in Kenya only well-established institutions and highly sophisticated investors are active and benefit from the share market because they have the resources required to mine, evaluate huge data and monitor the day to day activities of the share market in order to make wise decisions on what shares to invest in. This begs the question, what happens to potential individual and small scale investors?

The objective of this study was to design and develop a shares evaluation prototype system which will hopefully bridge this disparity by providing an easy, simple, straightforward and cost effective way to evaluate shares performance.

The outcome was a DSS shares evaluation system prototype that aids in easy decision making for both potential and existing investors in the share market. The prototype was evaluated by conducting a survey on users who used the prototype. The users were requested to rate the prototype based on the following parameters: satisfaction, ease of use, ease of learning and usefulness. The positive feedback received from the survey was an acclamation that the prototype was useful and a welcomed relief.

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LIST OF ACRONYMS

CDSC	Central Deposit and Settlement Corporation
DSS	Decision Support System
WPSS	Web-based Portfolio Selection System
NSE	Nairobi Share Exchange
MASST	Multi-Agent System for Share Trading
CDS	Central Depository System

CHAPTER 1 - INTRODUCTION

1.1 Introduction

The share market is a complex and tedious investment avenue. It takes diligence, financial muscle, time and high level of dedication to wade through the murky waters of the share market and fully benefit from the same. Unfortunately the share market industry is data intensive and if that is not enough the data keeps on changing on a daily basis. This requires a dedicated team of stockbroker analysts, time and financial resources to be able to participate and hopefully gain from this venture.

Currently in Kenya only well-established institutions and highly sophisticated investors are active and benefit from the share market because they have the resources required to mine, evaluate huge data and monitor the day to day activities of the share market in order to make wise decisions on what shares to invest in. This begs the question, what happens to potential individual and small scale investors?

Despite the leaps and bounds that have been made in the investment industry especially in the share market in other global markets, Kenya still lags behind in two fronts (i) Participation of individual and small scale investors in the share market (ii) Provision of value add services by the stockbrokers in terms of informative statements and statistics. Maybe this is intentional so that the stockbrokerage firms can make more business.

The following are some of the reasons why there is minimal participation of the individual and small scale institutions in the stock market:

- Lack of mechanisms to evaluate and monitor the constantly changing data.
- Lack of time to dedicate to monitoring the share market.
- Huge commissions charged by the stockbrokers to analyse shares and advise investors.

The only way to bring on board this category of investors is to come up with an easy, simple, straightforward and cost effective way to monitor share performance that provide a basis for easy decision making.

This was done by designing and developing a share performance evaluation system based on Decision Support System (DSS) model. DSS is an interactive, agile information system that

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utilizes decision rules and models to mine huge volumes of data from databases and present the relevant data in a simplistic form so as to facilitate users draw closer to making informed decisions easily.

1.2 Problem Statement

The current state of play for the current investors in the stock market is that they are only informed of what was their gain or losses in the shares they own in absolute monetary terms but no information is forthcoming as to how the investment portfolio or share performed viz a viz the market and if there are other alternatives to invest in.

In addition, for a potential investor there is no easy way of finding how the share(s) he/she wants to invest in has been performing over time. The only way to access this historical information and analysis is to hire a stockbrokerage firm at a huge fee or tediously mine data from the NSE. None of these options is appealing to a new investor especially an individual.

The proposed system seeks to address the issues faced by both the current and potential investor. The current investors only need to indicate the shares they own and the system will answer for them the following questions:

a) Did their shares gain or lose during trading?
b) Did the shares over perform or underperform when compared to the market?
c) Is there a share of almost equal value that performed better than the share they own?

Based on the feedback from the system the investor can make a very informed decision on whether to invest in another share or continue with the share and all this can be done at the comfort and convenience of a user wherever he/she is without engaging the services of a stockbroker or mining tonnes and tonnes of data.

For the new investors they only need to select the share they want to invest in and the period for analysis and in an instant the system will provide this information and again at the comfort of their home, office or wherever they are.

1.3 Significance

The shares performance evaluation will be beneficial to three players in the industry; investment managers, individual and corporate investors. From the point of view of individual and corporate investors, the ability to distinguish the performance of shares should be the main factor in altering the amount of resources allocated to different portfolio managers and also to best performing shares.

To the investment managers, they benefit from the continuous evaluation of performance by identifying the sources of the most profitable portfolios with a view of advising their clients and also improving their investment management record.

In general the investment industry will thrive and be able to attract both local (individual and corporates) and foreign investors based on the high level of efficiency

1.4 Research Objectives

- ➢ To design a DSS shares performance evaluation system.
- ➢ To develop a prototype DSS for shares performance evaluation.
- ➢ To evaluate and test the prototype.

1.5 Organisation of the Project Report

This study is organised into five chapters. Chapter one defines the introduction, problem statement, significance and the research objectives. Chapter two describes the literature review. Chapter three captures the methodology that was employed. Chapter four describes analysis, design and testing of the shares performance evaluation prototype. Chapter five shows the results after evaluation of the prototype. Lastly Chapter six describes the conclusion and future work.

1.6 Research Outcome

At the end of this research study, the deliverable was a prototype that was able to evaluate performance of shares in a given period.

1.7 Assumptions and Limitations

The research assumed that the CDSC and NSE will accept the interoperability between the proposed system and their respective databases. This study was limited to the NSE 20 share index.

CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction

The literature review is organized into three main areas. The first section is the background information on DSS. The second section summarises on the existing systems. Finally, the chapter concludes with a conceptual design of the prototype.

2.2 Background Information

The background information delves in detail to DSS. This section describes what DSS, types and components of DSS.

2.2.1 Decision Support Systems (DSS)

A DSS is an interactive computer-based system or subsystem intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions.

According to Power (2002), "DSS are designed specifically to facilitate decision processes, should support rather than automate decision making and should be able to respond quickly to the changing needs of decision makers".

As technology has evolved, data-driven decision support systems have become more sophisticated. According to Watson et al. (2006), "Data management for decision support has moved through three generations, with the latest being real-time data warehousing". The proposed system envisages the interface between itself and the NSE will be real-time so as to provide users with accurate information.

2.2.2 Types of DSS

There are several types of DSS which are classified based on their focus.

Communication-driven DSS

This type of DSS use communication technologies and networks to assist decision-relevant collaboration and communication. The tools that are normally used include groupware, video conferencing and computer-based bulletin boards. It supports more than one person working on a shared tasks.

Data-driven DSS

Data driven DSS mainly emphasizes on the access, manipulation and analysis of time-series huge volumes of data. It is used to query a database or data warehouse to seek specific answers for specific purposes. It is deployed via a main frame system, client/server link, or via the web.

This will be the type of DSS that will be used to design and develop the proposed system in this study.

Document-driven DSS

A document-driven DSS uses computer storage and processing technologies to provide document retrieval and analysis. Large document databases may include scanned documents, hypertext documents, images, sounds and video. Examples of documents that might be accessed by a document-driven DSS are policies and procedures, product specifications, catalogues, and corporate historical documents, including minutes of meetings and correspondence.

Knowledge-driven DSS

This type of DSS provides a specialized problem-solving expertise stored as facts, rules, and procedures. The "expertise" consists of knowledge about particular domain, understanding of problems within that domain, and "skill" at solving of these problems (Power, 2002).These system can suggest or recommend action to a user.

Model-driven DSS

A model driven DSS emphasizes access to and manipulation of financial, optimization and simulation models. They use data and parameters provided by decision makers to aid decision makers in analysing a situation. They are not data intensive.

2.2.3 Components of a DSS
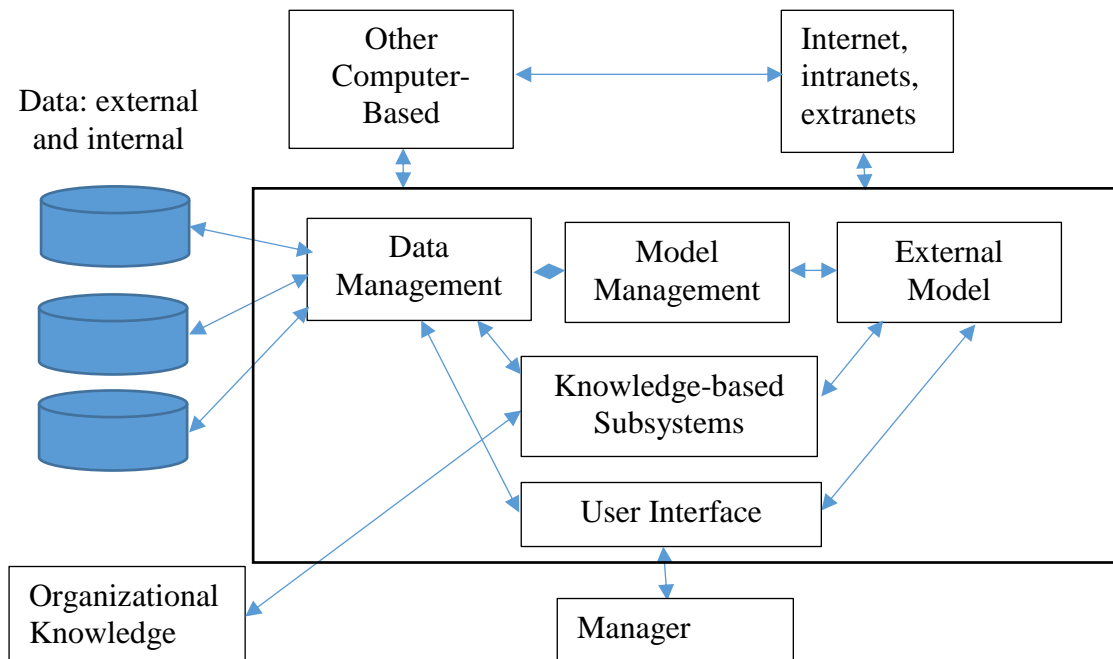
Figure 1: Schematic view of a DSS (K P Tripathi, 2011)

A DSS application can be composed of the following subsystems:

2.3.1 Data Management subsystem

This is a key component that includes a database, which comprises appropriate data for the specific scenario. This subsystem can be interconnected with internal or external data warehouses or any other relevant decision-making data.

2.3.2 Model Management subsystem

The model base provides decision makers access to a diversity of models and help them in making informed decisions. This component can be connected to external storage of data. The model base can comprise the model base management software (MBMS) that manages the use of models in a DSS.

2.3.3 Knowledge-based Management subsystem

This subsystem can support any of the other subsystem or act as an independent component. It provides intelligence to augment the decision maker's own. It can be interconnected with the organization's knowledge repository, which is called the organizational knowledge base.

2.3.4 User Interface subsystem

This component facilitates user's interaction with the DSS to obtain vital information. Normally this component is designed to be very user friendly and easy to understand so as to ensure what is captured is suitable in the quest to finding suitable results.

2.3 Existing Systems

A review of existing systems is imperative in order to chronicle what has been done before and how best it can be improved or even overhauled to achieve the desired outcome.

2.3.1 A Web-based Portfolio Selection System (WPSS)

Dong (2004) proposed a WPSS system for the Chinese financial market that mainly emphasised portfolio selection process as a series of tasks, rather than just solving an optimization problem. This framework focuses on the implementation of a decision support system based on the web where technology with features such as an online analytical processing. The framework they proposed contained five main stages as shown in Figure 2.
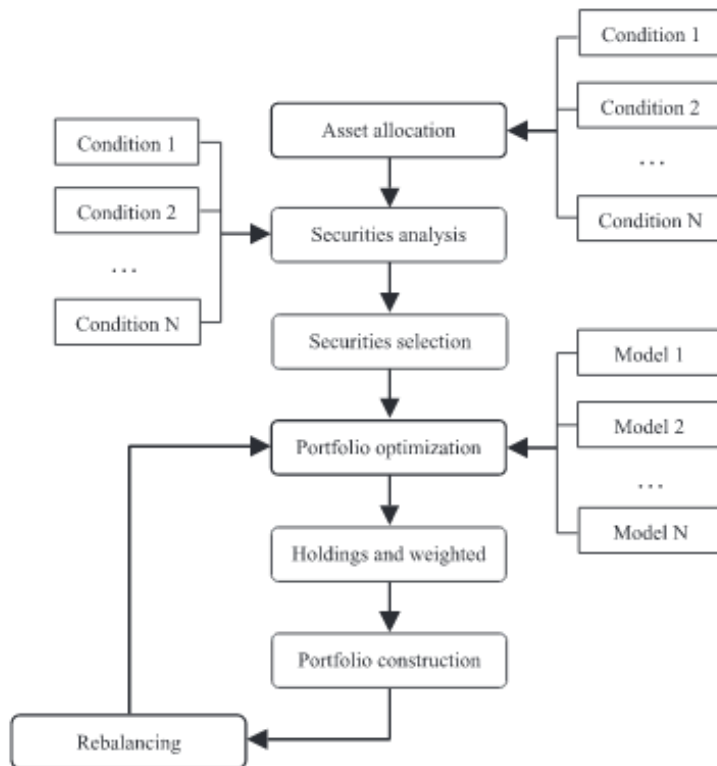
Figure 2: Web based portfolio selection system (Dong 2004)

Asset allocation

This is the stage where the investor's preference and optimal mix of assets on offer are taken into consideration and the ideal mix is presented to the investor.

Securities analysis

This is a stage which enables the investor to conduct an analysis of securities that may be considered for inclusion in a portfolio. Highlighted characteristics include price, average return, return volatility etc.

Securities selection

This stage uses profiling techniques where security attributes from the previous stage are examined in advance of the regular selection process. The intent is to remove any nonstarters and reduce the number of securities to be considered simultaneously in the portfolio optimization stage.

Portfolio optimization

As the main stage of the framework, portfolio optimization is to ensure optimal risk-adjusted returns by analyzing the portfolio and managing the assets.

Rebalancing

After the stage of portfolio optimization, holdings and weights of the optimal portfolio are decided, and investors may construct an optimal port-folio and make it into practice.

Advantages of the WPSS system

- It uses online analytical processing as an add-on tool for analytical purpose making efficient.
- It also uses Parallel Virtual Machine (PVM) to improve overall performance. A PVM is a program that enables distributed computing among network computers.
- It provides a user friendly interface for financial market investors.

2.3.2 Enhanced Decision Support System for Portfolio Management Using Financial Indicators

This system that was presented by (Masoud et al; 2012) had the intention of assisting in decisions making in regards to buying or selling a share through a specific group. Figure 3 shows the structure comprising of three blocks: input block, processing block and output block. The black and white boxes represent various metrics and data repository, respectively.

The purpose of the decision support system is choosing a limited number of suitable alternatives between all the available alternatives, and describes their output and suitability.
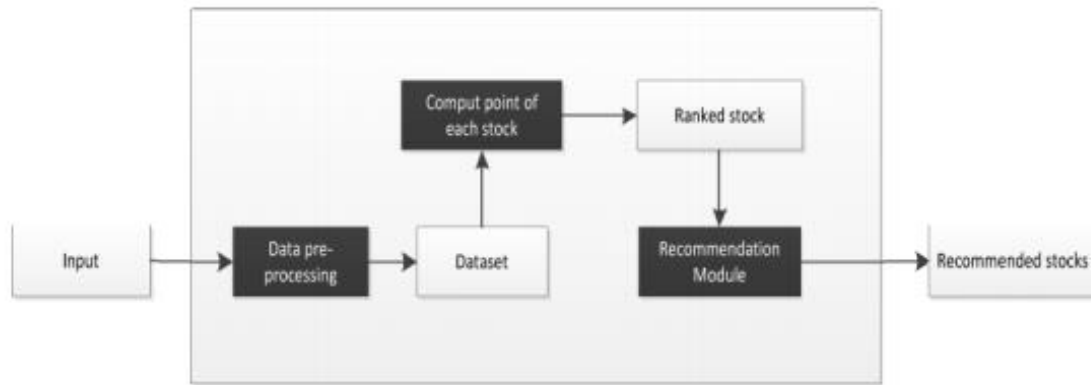
Figure 3: Enhanced structure of DSS for portfolio management (Masoud, 2012)

Advantages of the enhanced DSS for portfolio management using financial indicators

- Shares are grouped into two groups the oversold and the overbought. An oversold indicates a major reduction in price while an overbought
- The financial indicators are realistic hence high chance of an accurate decision.

Weakness of the system

- It only the shares in groups of 10 hence chances of losing out on other shares is high.
- It also doesn't factor in market return.

2.3.3 Multi-Agent System for Share Trading (MASST)

The key issues that this system addresses include gathering and integrating diverse information sources with collaborating agents, and providing decision-making for investors in the share market (Kecheng, 2000).

Figure 4: Framework for MASST (Kecheng, 2000)

One of the key components in this framework is the User Profile Database (UPDB), which is dynamic, changing and shared amongst agents within the system. For every user, they will have their own personalised interface agent and an individual user profile.

A summarised function of the system is as follows:

- Interface agent interacts with the user, receiving user tasks.

- Profile agent provides the mechanisms by which a user's profile is generated.

- The Monitoring agent monitors the status of a given share

- Whereas the Communication agent allows interaction with other agents.

- Risk agent on the other hand analysis the levels of the risk involved.

- Decision-making agent combines the outcomes of the technical analysis agent and the fundamental analysis agent, according to the investment strategies selected through the user profile.

- Technical analysis agent retrieves and processes the raw share trading data from the Internet, calculates various technical indicators, identifies various price and trading volume patterns, and gives the output to decision agent.

- Fundamental analysis agent gathers the macroeconomics data, fundamental financial status of the listed companies etc.

Advantages of MASST system

- It enhances gathering and integrating diverse information sources with collaborating agents, and providing intelligent decision-making for investors in the share market.
- The agent approach can be executed autonomously.

Weakness of MASST system

- The weakness of this system is that it does not take into consideration the market return. Market return is the difference in movement of previous day and current day's share points. In other words, market return are returns that investors generate out of the stock market.

2.4 Conceptual Design

The proposed decision support system provided a simplified way of evaluating a portfolio (mix of shares) to the current and potential investors in the share market in an endeavour to help them make the right decision on which shares to buy.
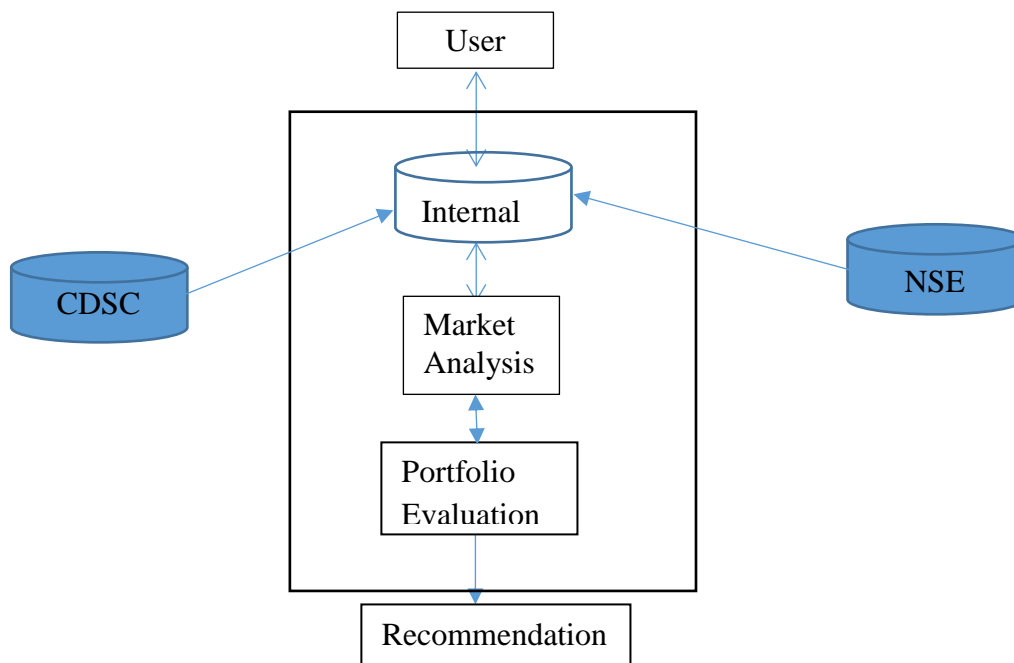

Figure 5: Proposed architecture of the prototype

The architecture depicted in figure 5 has four major components and the general functionality is as follows:

User

The user interface is the first point of contact by the user. For current investors all they need to input is there Central Depository System (CDS) account number and the system will query the CDSC database for the shares the user currently holds. For the potential investors all the need to input is which share they would like to invest in and the system will do the rest.

Market Analysis

This component calculates the market return that is used in the shares performance evaluation. The market return is basically the difference in movement of current and previous day share points.

Portfolio Evaluation

As intimated in this study, one key component that is missing in the existing systems is the comparison of the portfolio performance vis a vis the market return. This component will help the investor know whether the shares are outperforming or underperforming the market.

External Data

The proposed system will rely on two external data, however if the integration with Nairobi Stock Exchange (NSE) and CDSC database will not be possible the proposed system allows of bulk upload of data into the local (internal) storage.

Essentially the NSE will provide the following:

- Daily movement of shares.
- Data to calculate market return.

The CDSC database holds data pertaining to the shares that individual and institutions are holding. This information can also be entered through the user interface in the event the CDSC database is not available.

Recommendation

The last component is the recommendation that the proposed system will give the user based on the parameters the user entered. The recommendation will have the following possible information:

a) What was the market return in the period of interest?

b) Did the shares held by the investor underperform or over perform the market.

c) The alternative shares of almost equal value the investor can opt to invest in, in the event the current shares held underperformed the market.

CHAPTER 3 – METHODOLOGY

3.1 Introduction

This study employed various steps in order to fulfil the overall objectives laid out in chapter one. The steps are as elucidated below:-

i.   System specification

A system specification describes the operational and performance requirements of a system. It is considered a high-level document that prescribes over-all functions.

System specifications aid in defining the operational and performance guidelines for a system. It may outline how the system is expected to perform, and what that may include. Key specifications may include interface definitions, document design rules and functional areas.

ii.   System design

System design is the systematic approach of defining the architecture, components, units, interfaces, and data for a system to fulfil itemized requirements. The process is systematic wherein it takes into account all related components of the system that needs to be created.

Systems design then overlaps with systems analysis, systems engineering and systems architecture.

iii.   System implementation

System implementation is the process of outlining the delivery phases of the system and ensuring that the system is operational. Also to ensure that the system meets quality standard.

iv.   Testing and evaluation

The system should be designed and developed to meet the system and functional requirements specified. Once that is done, the next step is to evaluate. The main objective of carrying out this evaluation is to verify how well the system fulfils the intended objectives. This basically means the system or components are compared against requirements and specifications through testing.

3.2 Context –Based DSS methodology

Dey and Abowd (1999) defined "context" as any information that can be used to characterize the situation of an entity. An entity in this study is a shares evaluation application. The decision maker as the user. When a system uses input context characteristics to provide information to aid a user make a decision it is deemed to be context aware.

This study adopted the phased development life-cycle by Sage (1991) which was later reviewed by Pick (2008). This methodology has seven phases but can be amalgamated depending on the context involved. In the context for this study the phases have been reviewed to four and details are enumerated below.

3.2.1 Identify requirement specifications

This development phase deals with the following:

- Identify the user interface requirement.
  In a nutshell this defines how the developer wants the user to interact with the system. A user interface is key to successful implementation and use and hence should be designed and implemented with a lot of keenness.

- Needs of data integration.
  Most systems no longer work in isolation and hence a form of system and data integration is required to ensure the system perform and achieve its objective. What is required to facilitate the data integration is captured at this stage.

- Needs for data backup and maintenance.
  It is a necessity for a system to have a mechanism of backing up the data so as to be able to restore the data in case of a disaster. This will be handled at this stage.

3.2.2 Preliminary conceptual design

The main activities involved in this phase are:

- Define the inputs involved
  In order for the system to process information and deliver the outputs it has to have some inputs. In the case of the shares performance evaluation system the inputs were: daily share prices, daily market index etc

- Define the outputs involved

  Systems are built to meet certain objectives and in most cases the outputs are usually used as indicators of how well the system was designed and implemented. In the case of the prototype in this study the output was the recommendation and also the shares analysis reports.

- Determine software and hardware required

  Depending on how a system will be used certain software and hardware components are required. For instance if a system is resource intensive then high calibre hardware needs to be in place to support the system requirements.

- Identify database specifications

  There are many databases in the market with competing strengths and it is advisable to select a database that will support the system requirements. Identification of database specifications in terms of performance, reliability, interoperability is done at this stage.

3.2.3 Logical design and architectural specifications

This phase consists of the following main activities:

- User interface design

  After the analysis of the user interface requirement the next activity is to design the user interface itself. At this stage the user interface requirements comes to life. As reiterated before the user interface design will go a long way in facilitating usability of the system.

- Process modelling of shares comparison and advice

  The ultimate goal of shares performance evaluation is to analyse and recommend shares that are performing well currently and also in the near future. In order for the system to do that some logic has to be embedded in the system and this is done at this stage.

- Model data and strategic design of the maintenance and backup

Actualising of the data backup and restoration requirement is done at this stage. The analysis of the data backup is continually designed at this stage until perfection. Testing of the backup will be done in the next stage which is detailed testing phase.

3.2.4 Detailed design and testing

This phase consists of the following main activities:

- Select couple of shares for testing purposes

Once the requirements have been carried out the design phase has been completed the next stage is to set the testing parameters. In regards to the shares evaluation system prototype a few shares were selected for detailed testing to ensure the system works as its supposed to.

- Testing the user interface

The user interface is like the door to the system, the design and testing has to be on point. This particular tests involves asking users how friendly and usable the system is. A lot of things happens in the background of the system which users shouldn't be distracted with. Only what is necessary is shared to the users through the user interface and hence this stage of testing is absolutely critical.

3.3 Sources of Data

This study sourced its data from CDSC which provided the security holdings per client. In the event that this integration will not be possible the prototype will have a backup feature which will allow the corporate and individual investors to input the shares they hold. The NSE database integration provided the daily shares prices but also a manual override was also provided to upload the data manually.

3.4 Data Collection

The data was collected by downloading from the NSE website and other data was collected from the user. This data included:

a) Daily share price

Every share in the stock market has a price to it. Depending on how it performs on the stock market the price can go up or down. This daily change in price is what was captured.

b) Cost of purchasing the shares

Investors would need to know what their profit margins or what they have gained after sale of shares. Hence this data was captured so as to inform the investor of his/her earnings.

c) Selling price of shares

In order to give a detailed and informative report the selling price of a share has to be captured. This was used to computes an investors earning during share trading.

d) Value of share index which determines market return

The share index is a series of numbers which shows the changing average value of the share prices of all companies in a stock exchange. It is used as a measure of how well a market is performing. This value was collected in order to computer how one stock was preforming against the market.

3.5 Data Analysis

The data collected was processed to eliminate any errors, anomalies. It was then classified then analysed using Excel. Since the data collected was in soft and it was also coming from a database it was easier to use Excel because the data was already formatted and Excel is a much cheaper and readily available analytical tool.

CHAPTER 4 – DESIGN AND IMPLEMENTATION

4.1 Introduction

The most important and initial idea of the proposed system aimed to offer a platform where an investor can realize shares performance evaluation on his/her own without the need of a stock broker or any other 3rd party.

This chapter provides summary of the system design and implementation process. It is organised as follows: 4.2 describes the user requirements, 4.3 depicts the system design and lastly 4.4 summarizes the testing and implementation.

4.2 System Functional Requirements

In order to comprehensively design and develop a system, a summary of what the user expects from the system should be established. This will help to inform the design process and implementation method to be undertaken.

In regards to the shares performance evaluation system the following is a listing of what the prototype is expected to do once it has been developed and implemented.

No	Requirement
1	Ability to add, edit and delete users
2	Assign different rights to different users
3	Add, modify, deactivate shares
4	Add, modify and delete user rights
5	Ability to upload daily share prices.
6	Ability to upload daily market index

7	Access system from any device.
8	Analyse shares based on • Period • Market return • Other shares
9	Evaluate shares and answer the following: a. Did their shares gain or lose during trading? b. Did the shares over perform or underperform when compared to the market? c. Is there a share of almost equal value that performed better than the share they own?
10	Ability to show evaluation results both in tabular and graphical format.
11	Ability to show top 5 gainers and losers within a given period
12	Control access to users using complex passwords
13	User friendly

4.3 System Design

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development.

The high level design in summary of the shares performance evaluation system is that it has two different basic modules; Administration and User modules. The administration role is concerned with the following:

✓ Management of users i.e. create, edit and delete users etc.

✓ Upload of daily stock prices.

✓ Upload of daily market index.

The user module is primarily the module whereby users evaluate how a particular share was performing. The system in addition has basic function modules, such as the Home page, My Profile Page, Shares Evaluation Page.

4.3.1 Architectural Design

This was one of the early stage of the design process and it represented a link between system requirements and design process. It involved identifying major systems components and their communication.

The following section describes the architectural design process of the shares performance evaluation system.

4.3.1.1 High Level Components

- Shares Component

This was one of the key components of the Shares Evaluation System. This was where the new shares were captured and edited in case of any changes.

- Market Index Component

This was also an important component in the system, it captured the daily market index as captured and announced by Nairobi Stock Exchange (NSE). It was an important component because it assisted a user know if the shares were over performing or underperforming the market.

- Upload Component

This module worked hand in hand with the shares component in that the daily movement in share prices that was provided by the NSE was uploaded into the database via this module.

- Authentication and User Management Component

Another component was the user management that was responsible for the security of the Shares Performance Evaluation System. It authenticated users and also handled the user management activities such as creating new user accounts, removing accounts from the system etc.

4.3.1.2 Inputs

- Daily share price from NSE

   The NSE on a daily basis publishes the price of all shares/stocks that are trading and this price listing is what was uploaded to the system. This input was key in that it was used to show how the share had been performing over time. The daily share prices are downloaded in Excel format.

- Shares in the portfolio

   In the event it's a portfolio that was being evaluated then shares that madeup the portfolio had to be entered into the system. This was important in that the system could evaluate the individual shares in the portfolio and also evaluate the shares as a portfolio.

- Value of Market Index

   In addition to the daily share price that is published daily by the NSE, is the market return. This indicated how the market had been performing as a whole. This was input uploaded to the system and it was used to measure how a share was performing viz a viz the market.

- Evaluation period

   The user of the system was required to indicate the period in terms of days within which the evaluation should focus. Investors would want to evaluate how a share has been

performing over a long or short period depending on their preference and hence it is imperative to give the investor an option to enter evaluation period.

4.3.1.3 Logic of shares performance evaluation

In a nutshell, the logic was that once the daily price of shares and the market index had been uploaded into the system. The investor/user was able to select the share to evaluate and the period of evaluation. Based on these parameters the system generated a report showing the performance against the market performance and also against another share of equal or almost equal value in share. This was determined by computation of the following:

- Daily returns for individual shares
  The return of an individual share was derived using this formula

    Daily Return: (P1-Po)/Po

    Where P1 was the current share price Po was the previous day share price.
    The sum of the daily return of a particular share over a period of time was then used
    to compare with other shares. If the sum was higher than the share being evaluated
    then it meant that share is performing better.

- Computation of daily portfolio return
  In the case where it was a portfolio which was being evaluated the formula was as
  follows:

    Portfolio Return: $\sum wiRi$

    Where *i* is the stock, *wi* is the weighted average and *Ri* is the expected return on stock
    i.

- Market Return
  The market return was calculated using this formula

Market Return: (Mkt index t) - (Mkt index t-1) / (market index t-1)

Where *t* denotes the current market index and *(t-1)* is the previous day market index.

4.3.1.4 Output

- Daily Shares Return

  This is a report that showed the daily return of all the shares in NSE not necessarily the share that an investor wanted to evaluate.

- Market Return

  In addition to the daily shares return the system generated the daily market using the formula described in the previous section.

- Comparison of market return and share return

  The system was also able to generate a report showing comparison of the market return and the individual share of interest.

4.3.2 Database Design

The database was the component where all records were stored. The database had three main entities which were Stock, MarketIndex and StockTran.

In a nutshell the Stock entity held information of all the shares in Nairobi Exchange, while the MarketIndex entity captured the daily movement of the market index. In regards to the StockTran entity, it held the daily movement in share prices. The Userdetail entity held information of users who were authorised to use the system.
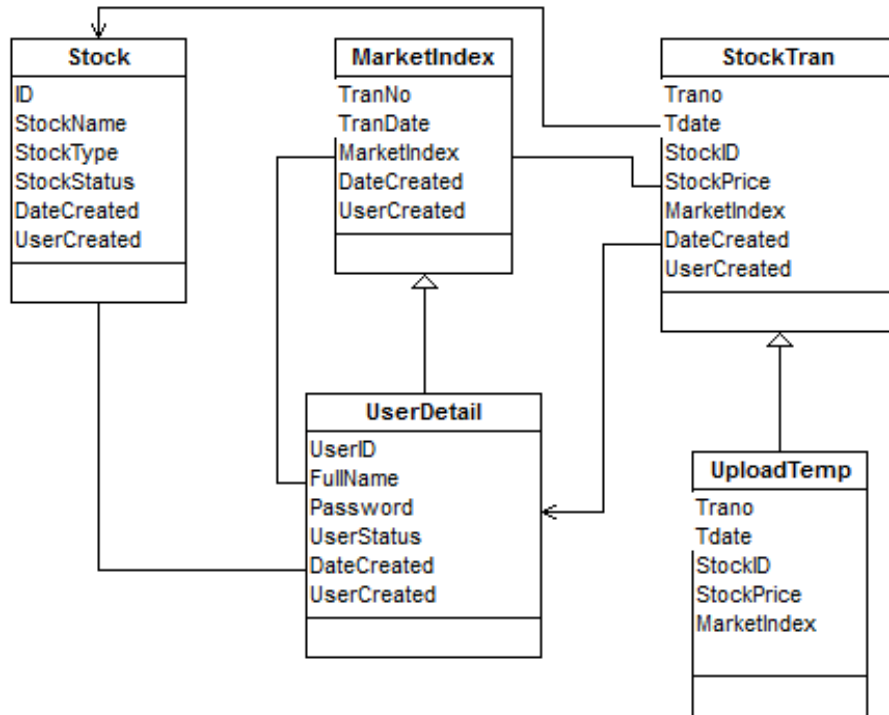
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Figure 6: Database Design

4.3.3 Web Pages

Webpages are the components that display the application's user interface (UI). Typically, this UI was created from the model data. In the shares performance evaluation system the webpages were displayed using client browser that the user was using.

Table 1: Interface Overview

Webpage	Sub Module	Description
Shares Component Interface	SharesProfile	This webpage was used to input new shares in the market and also edit any changes relating to a specific share.
	SharesTran:	This was a webpage that was used to capture the daily movement in share prices for a specific share. It was a complement of the upload component interface.

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|		
Market Index	MarketIndex	This was a webpage used to view and edit daily movement in market index points.
Authentication and User Management	newUser	This was a webpage used by the administrator to add new users to facilitate them access the system.
	editUser	In this webpage the administrator or user is able to edit the existing user profile.
Upload Interface	uploadData	This webpage was used by the administrator to upload the daily market share index and share movement.
Report Interface	Reporting	This was a view that displayed performance of the share and a possible advice to the user based on the share queried.
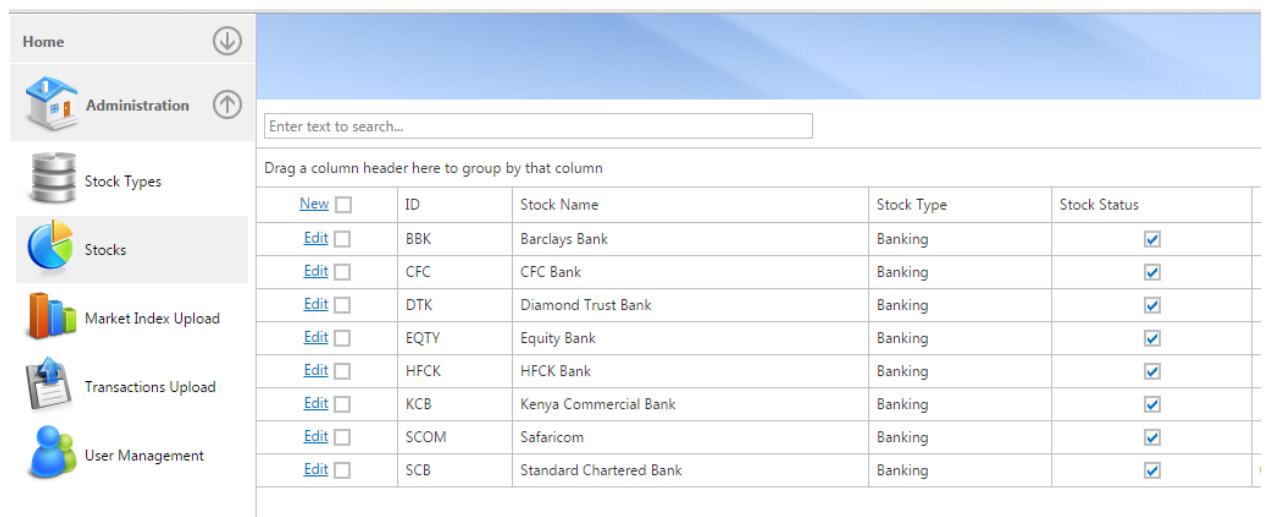
Figure 7: Typical Webpage Design

A typical webpage design is shown above. Essentially on the right is the menu and on the left is the content display. The following are the controls on the webpage:

- Gridview

Grid-view table was used for combining the corresponding data from the database and organize with some format to present the information what the users can consume easily.

- Textbox

It is the basic component in the webpage. The user keyed in what they wanted to publish in the text-box and the content was stored into the corresponding table in the database through the back-end operation. It was also used to facilitate searching of records in the gridview.

- Links

The links in the webpage are replacement of the widely used buttons. The available links are New, Edit. This links facilitated creation of new records and also ammendments of the records in the database.

4.3.4 Interaction Diagrams

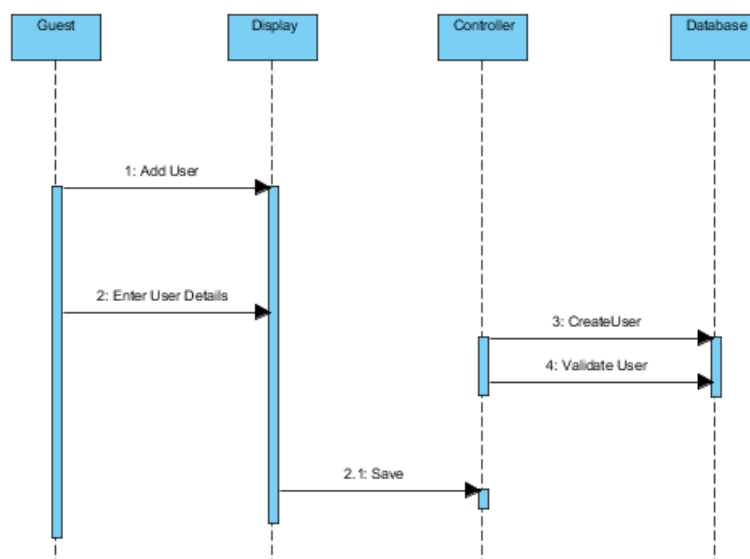The interaction diagram below depicts how a user creation is facilitated in the system.

Figure 8: Interaction Diagram - User Creation

In addition the system also handled capturing of new shares in the system and below is how a share was booked in the system.
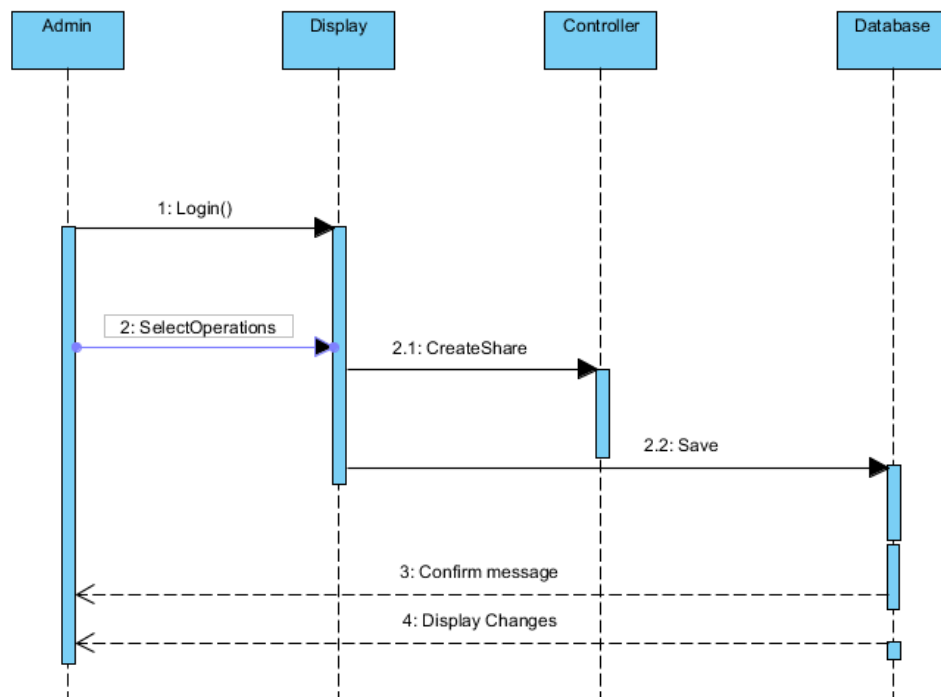

Figure 9: Interaction Diagram - Share Creation

4.4 System Testing and Implementation

The main purpose of the system was evaluating performance of shares in the Nairobi Stock Exchange. The backend of the system was MS Sql database, web server was used to facilitate the graphical interface and communication with the database.

4.4.1 Implementation Tools

✓ System setup files

These are files that are generated after design and development of the system. They were used to install the system in the client.

✓ Databases – MS SQL Database

Database was the component that was used to store all the data that was uploaded or keyed into the system. The database of choice was Microsoft SQL database but ideally any other database was ok to use.

✓ Laptop or desktop

A laptop was need to run the system.

✓ Microsoft Office

Some reports were extracted in Excel format and hence MS Office was required to facilitate this.

✓ Any browser

The system was browser based and hence to be able to use the system a browser has to be installed on the laptop or desktop machine.

✓ Webserver

The primary function of a web server is to store, process and deliver web pages to clients.

4.4.2 Black box testing

Black box testing is the Software testing method which was used to test the software without knowing the internal structure of code or program. Black box testing was applied during the development of project work. Black box testing was primarily used for testing the functionality of the system.

Table 2: Website Function Blackbox Testing Listing

TEST NUMBER	TEST NAME	EXPECTED OUTCOME	ACTUAL OUTCOME	PASS /FAIL
T-001	Create New Users	Successful creation of New users by the Administrator	All New users were created by the Administrator and displayed	PASS

T-002	Create New Users Without information filled.	An error should pop and creation of the user should fail.	An error message is displayed.	PASS
T-003	User Authentication	For all Authenticated Users the Log in session is successful	All Authenticated Users successfully logged into the system while Unauthenticat Users login failed	PASS
T-004	Upload module	Data uploaded is validated and successfully stored in the database.	All the Reports in the correct format were successfully parsed into the various department	PASS
T-005	Evaluation of Shares Performance	Evaluate the shares based on what the user has select and the period to evaluate	Shares evaluated and recommendation given	PASS
T-006	Save Data	For all information submitted the data is saved in a common repository	All information submitted is committed into the common repository	PASS
T-007	Search Information	The system returns the information from common repository	All information searched from the common repository using predefined criteria were displayed	PASS
T-008	Plot Chat	Successful creation of charts based on the data selected	Charts successfully created	PASS

CHAPTER 5 - RESULTS

This Chapter shows the results of the implementation on a web browser and it also summaries potential users' review of the system. Screenshots of the user interfaces and the resulting webpages are then described. The best way to demonstrate the success of the developed web based system would be to let potential users use it and then let them rate the system. In ashow screenshots depicting various modules of the system.

The subsequent figures and tables depicts the contents of test obtained from the system and results.

5.1 Prototype Modules

5.1.1 User Creation

The figure below shows how a user is created in the system. The user creation form requires the following user details to be keyed in for the user to be successfully created:

- ✓ User ID

  The user id depicts the unique name that the user will be using to login into the system.

- ✓ Full Name

  This field depicts the full name of the user for ease of identification.

- ✓ Password

  This depicts the password the user will be using to login to the system.

- ✓ Type of user

  This field depicts what role the user will have in the system. If the administrator option is selected then the user will have admin rights otherwise the user will be marked as a normal user.

Figure 10: User Creation

5.1.2 User Login Screen

For a user to successfully login into the system he/she has to have a valid user name and password to be authenticated to use the system.

Figure 10 shows the login screen of the system. It also shows a user who has tried to login using a wrong password and the system threw an error message.

Figure 11: Depicting a failed login

5.1.3 Upload of Daily Share Prices

Figure 11 depicts the share price upload form. This form has the following controls:

✓ Choose file button
The function of this button is select the file containing the daily share prices that has been downloaded from the NSE website.

✓ Click to upload button
This button is used to upload the file that has been selected for upload.

✓ Data grid
The data grid displays the daily share prices that have been uploaded successfully into the system.

In summary these form was used to upload daily share prices into the system. These prices forms part of important parameters used to evaluate the shares.

#	Trano	Tdate	Stock ID	Stock Price
	1	30/09/2015	SCOM	15
	2	29/09/2015	SCOM	15
	3	28/09/2015	SCOM	15
	4	25/09/2015	SCOM	15
	5	24/09/2015	SCOM	15
	6	23/09/2015	SCOM	15
	7	22/09/2015	SCOM	15
	8	21/09/2015	SCOM	15
	9	18/09/2015	SCOM	15
	10	17/09/2015	SCOM	15

Page 1 of 9 (88 items)   1 2 3 4 5 6 7 8 9

Figure 12: Upload of Share Prices

5.1.4 Evaluation of Share Performance

For the user to evaluate a share's performance he/she selects the preferred share and also the period for evaluation. The system then does two things:

✓ Evaluation of share against the market.
✓ Selects an alternative share that has been over performing the market in the same period selected by the user.

Figure 12 shows the user has selected Safaricom share and the period is 1st week of September 2015.

Table 3 shows the analysis in tabular form for users who prefer seeing the analysis in table form. It clearly shows that Safaricom is underperforming the market.

Table 3: Safaricom Share Performance In Tabular Form

Safaricom Shares Performance Against The Market			
Date	Market Return	Safaricom Daily Return	Remarks
07/09/2015			
06/09/2015	0.1	-1.4	Underperformed
05/09/2015	0.5	0.0	Underperformed
04/09/2015	1.4	-1.7	Underperformed
03/09/2015	-0.5	-2.4	Underperformed
02/09/2015	0.6	3.9	Overperformed
01/09/2015	-0.6	0.0	Overperformed

The system also generates a graph for users who prefer using graphs rather than tables. Graphs are much easier to consume and also shows the trend. This can assist an investor make decision very easily. The analysis of the Safaricom share against the market shows for the better part of that week it has been underperforming the market.
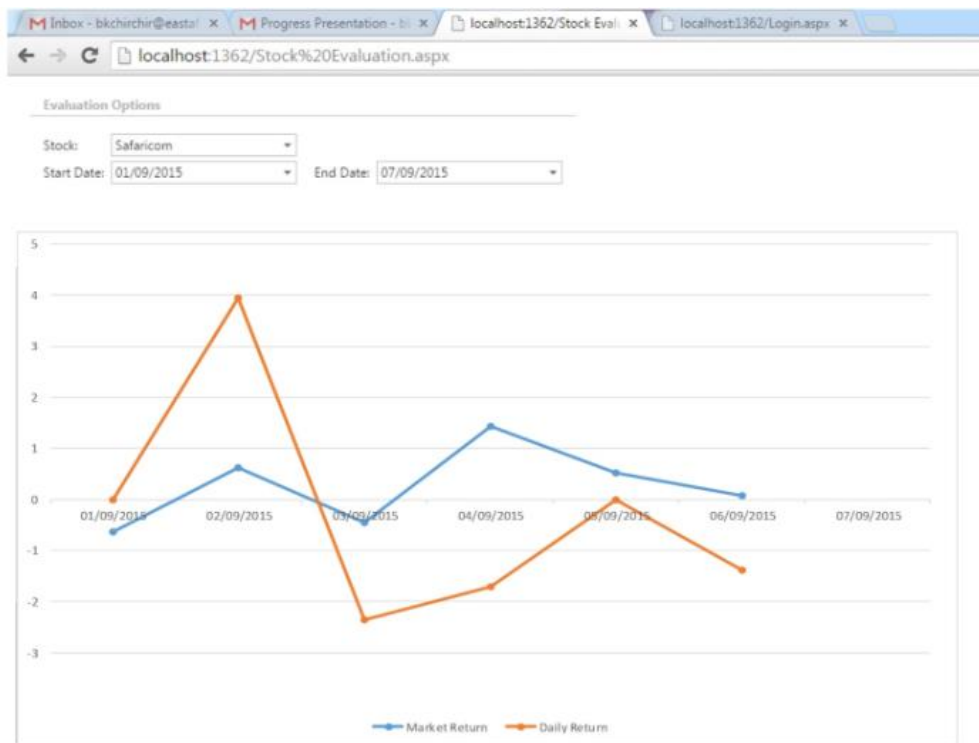
Figure 13: Safaricom Share Performance Against The Market

Automatic selection of a better share based on logic embedded

The second phase of the evaluation process by system is to select a share that is performing fairly well against the market and also against the users/investors choice.

Table 4: Barclays Share Against The Market

Date	Market Return	Barclays Daily Return	Remarks
07/09/2015			
06/09/2015	0.1	0.3	Overperformed
05/09/2015	0.5	0.0	Underperformed
04/09/2015	1.4	2.0	Overperformed
03/09/2015	-0.5	0.5	Overperformed
02/09/2015	0.6	2.0	Overperformed
01/09/2015	-0.6	0.0	Overperformed

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Clearly Barclays share is performing well against the market and this share is automatically picked by the system based on the logic embedded behind the system.
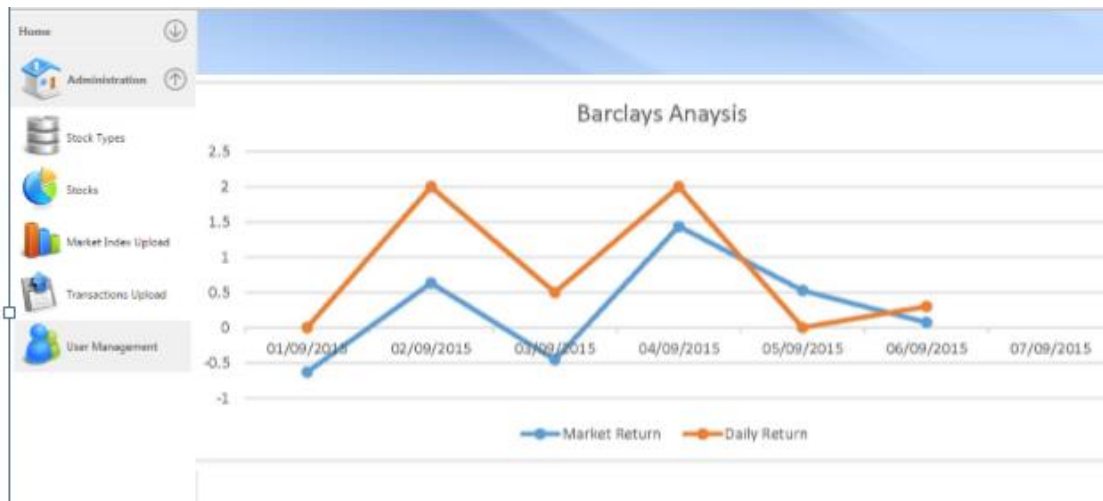

Figure 14: Barclays Share Against The Market

As described above, the system has demonstrated from how a user is created, data from NSE is uploaded and how share performance is evaluated.

Based on the user selection of Safaricom share and the period, the system was able to determine that Safaricom is underperforming the market. The system further as expected recommended Barclays share which was clearly doing well against the market performance.

5.2 System Evaluation Results

Evaluation of the share performance evaluation system was done by drawing respondents from small scale investors and stockbrokers. The survey conducted involved respondents answering four questions. The questions were designed to depict the following parameters:

- ✓ Contentment with the system
- ✓ Ease of use
- ✓ Ease of learning
- ✓ Usefulness

Table 5: Respondents review frequency for each question

No	Questions	Rating		
		Strongly Agree (3)	**Agree (2)**	**Strongly Disagree (1)**
1	Was the recommendation made by the system valuable?	22	2	0
2	Is the system easy to use?	19	3	2
3	Is the system easy to learn?	19	4	1
4	Would you recommend the system to others?	21	3	0
Mean		20.25	3	0.75
Overall evaluation in Percentage (%)		84.4	12.5	3.1

The first cell of the top header row spans the full table width and reads: **Respondents Review Frequency For Each Question**

a) Contentment with the system

This parameter is basically used to determine how satisfied the users are with the system. The question "Would you recommend the system to others?" was used to judge the satisfaction of the users with the system. The users who answered affirmatively to this question were basically endorsing the prototype. The users who were satisfied with the system were 22 which translated to 91.7 %. The following graph depicts how users responded.

	Strongly Agree	Agree	Strongly Disagree
Contentment	91.7	8.3	0.0
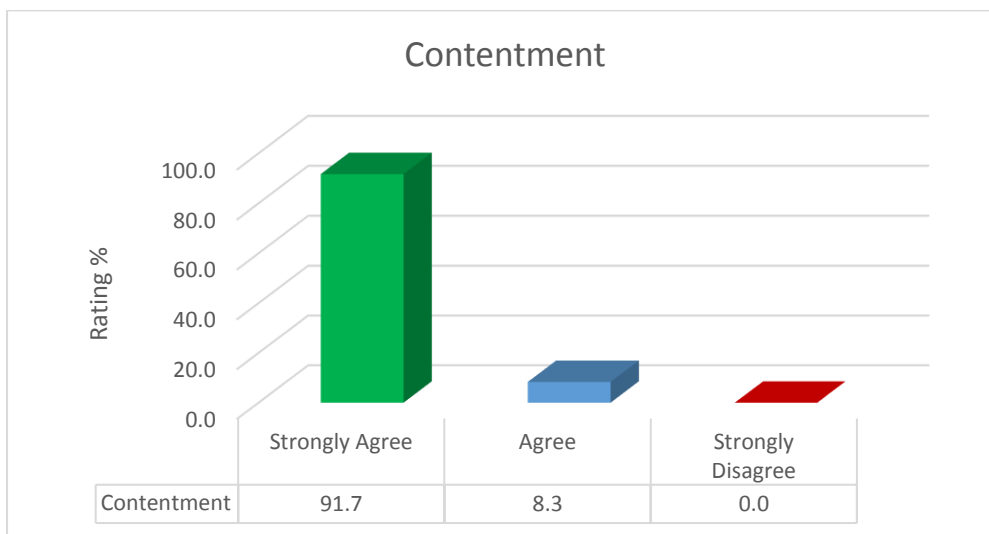
Figure 15: User's System Satisfaction Evaluation

b) Ease of Use

This parameter essentially assists to evaluate how easy users found the prototype to be. The question that was posed to link to this parameter was "Was the system easy to use?" Obviously the users who answered affirmatively found the system easy to use. The number of responded who "Strongly Agreed" that the system was easy to use were 79.2 % while those who "Agreed" where 12.5 %. Only 8.3% did not find the system easy to use.
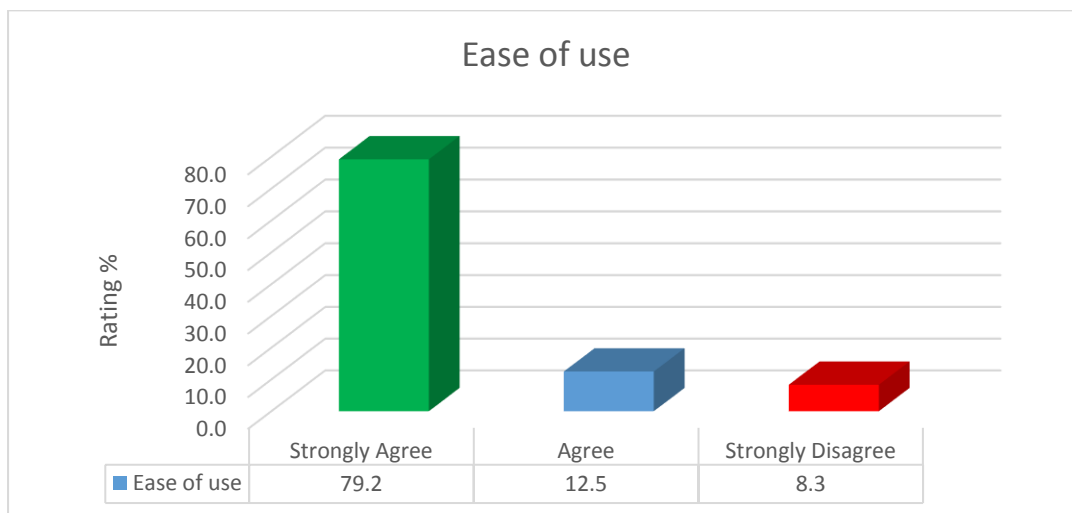

Figure 16: System's "Ease of Use" Ratings

c) Ease of Learning

The prototype will definitely not be user friendly if it is not easy to learn. Users prefer systems that are easy to learn hence making their work easier and navigation through the system better. That is why this was an important parameter to evaluate the system. The following graph depicts how users evaluated the prototype in regards to how easy it was to learn the system. The rating given to the prototype in regards to ease of learning was 79.2%.
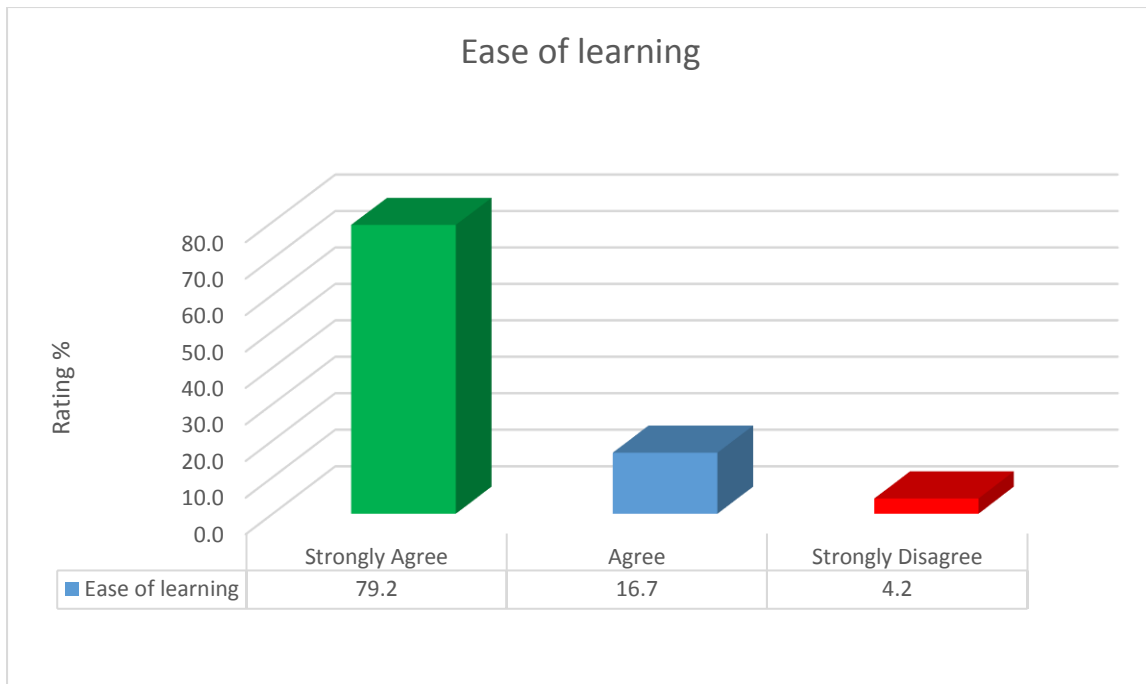
Figure 17: "Ease of Learning" Evaluation

d) Usefulness

Last but not least was the "Usefulness" parameter. The question that was linked to this parameter was "Was the recommendation made by the system valuable?" One of the key reason for developing the prototype was to recommend shares that were performing well in the stock market to the investors. Hence it was imperative to get feedback from the users on how valuable the recommendation given by the prototype was. The users who "Strongly Agreed" and "Agreed" that the system was useful gave the rating of 87.5% and 12.5% respectfully.
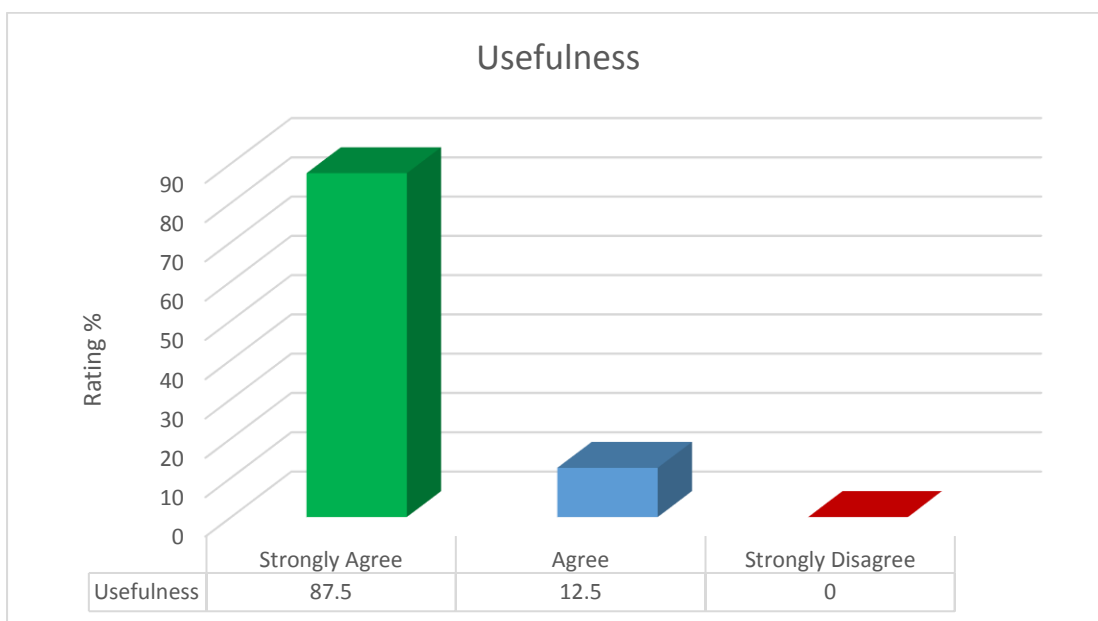

Figure 18: Prototype's "Usefulness" evaluation

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Overall Evaluation

The questionnaire questions were intended to capture an overall perception of the prototype by the users. This is presented graphically in the figure 19. From the data collected the number of users who "Strongly Agreed" and "Agreed" that the prototype was beneficial out ways those who didn't find the prototype to be satisfactory. This shows that the users have a positive perception about the prototype and if the prototype is developed into a full system they will likely use it to evaluate shares performance.
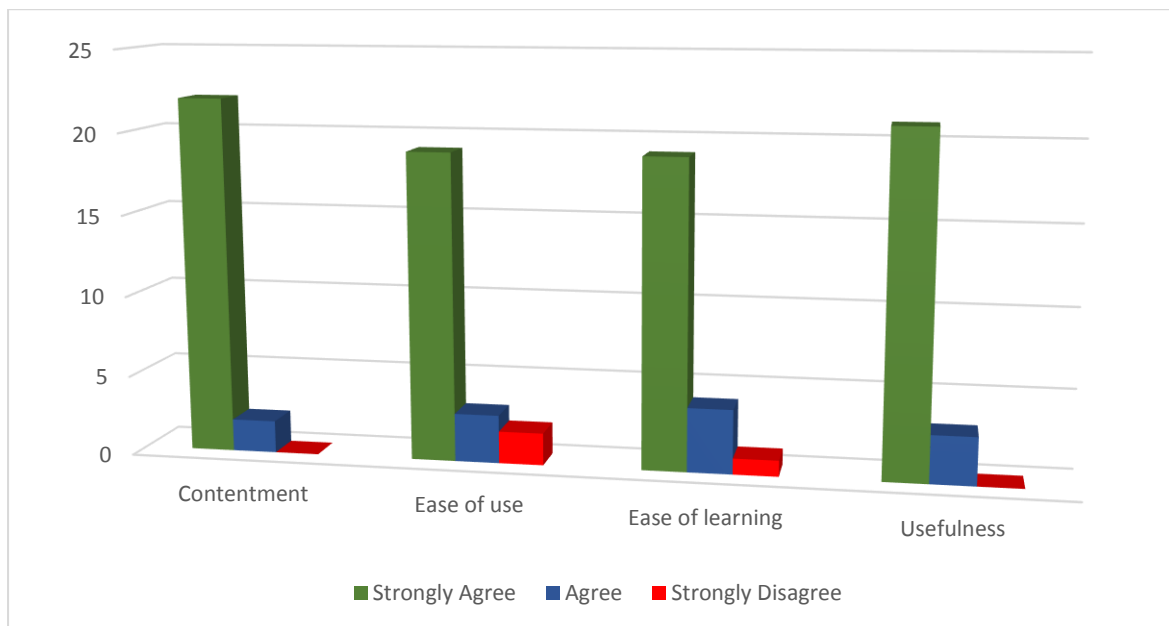

Figure 19: Overall System Rating

CHAPTER 6 – CONCLUSION AND FUTURE WORK

Chapter overview

This chapter summarizes projects conclusion, challenges, limitations, recommendations and further work.

6.1 Conclusion

The main objective of this study was to design, develop and evaluate a DSS shares performance evaluation prototype. Contect-based DSS methodology was employed to realise the objective of successful design and implementation of the prototype.

The prototype was subjected to through and systematic testing and evaluation by users. The results of the system evaluation and testing show that 84.4% of users gave the system a strong rating. This proved that DSS based system is a better solution to small scale and individual investors in facilitating quick share analysis and evaluation to enable faster decision making. The system can be used by even large scale investors and brokerage firms not necessarily the small scale and individual investors.

All in all the overall objective of the project was met and it is with great confidence based on the user's rating that the prototype will go a long way to bridge the gap between the individual and institutional investors.

6.2 Challenges and Limitations

The NSE currently has a couple market indices that enable investors to measure the performance of the major industry segments of the shares market. The study was limited to the NSE 20 share index which is the most commonly used market index.

6.3 Recommendations and Future Work

Based on the results achieved, it is apparent that a DSS based system is an answer to easy and simple share evaluation process.

The study was only limited to single share entities. Further study should extend to analysis and evaluation of shares as a portfolio.

In addition, the system relies in manual upload of daily share prices and market index. Additional study should be directed towards automating the database with real time data upload from the NSE.

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APPENDIX

Appendix I

The following companies make up the NSE 20 share index that was used in testing the prototype. The list includes the sector in which the companies are found.

Sector	Company
Commercial & Services Sector	• Kenya Airways Limited • Nation Media Group • Scangroup Limited
Investment Sector	• Centum Investment Company Ltd
Banking Sector	• Kenya Commercial Bank Limited • The Cooperative Bank of Kenya Limited • Standard Chatered Bank Limited • Barclays Bank Limited • Equity Bank Limited • CfC Stanbic Holdings Limited
Manufacturing & Allied Sector	• East African Breweries Limited • British American Tobacco Kenya Limited
Construction & Allied Sector	• Athi River Mining Limited • Bamburi Cement Limited
Energy & Petroleum Sector	• KenolKobil Limited • Kenya Power Limited • Kenya Electricity Generating Company Limited
Insurance Sector	• British-American Investments Company (Kenya) Limited
Telecommunications & Technology Sector	• Safaricom Limited

Appendix II

Name:			
Evaluation Date:			
Overall			

No	Questions	Rating		
		Strongly Agree (3)	**Agree (2)**	**Strongly Disagree (1)**
1	Was the recommendation made by the system valuable?			
2	Is the system easy to use?			
3	Is the system easy to learn?			
4	Would you recommend the system to others?			