RELEVANCE OF PROGRESSIVE TECHNOLOGY AT THE SECURITIES EXCHANGE: CASE STUDY OF THE NAIROBI SECURITIES EXCHANGE

BY

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UNITED STATES INTERNATIONAL UNIVERSITY

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A Research Project Report Submitted to the Chandaria School of Business in Partial Fulfilment of the Requirement for the Degree of Masters of Business Administration (MBA)

UNITED STATES INTERNATIONAL UNIVERSITY

FALL 2016
DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted to any other college, institution or University other than the United States International University in Nairobi for Academic credit.

Signed: ………………………………..  Date: …………………………………………

Ruth Mburu (ID No. 644496)

This project has been presented for examination with my approval as the University Supervisor.

Signed: ………………………………..  Date: …………………………………………

Mr. Sammy Lio

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ABSTRACT

The purpose of the study is to determine the effect of adopting progressive technology at the Nairobi Securities Exchange. The specific objectives are: First, to assess the systems currently in place at the NSE, Second, to determine the factors limiting technological advancements at the NSE, and finally to analyse the technology being used in the leading securities exchanges worldwide in order to supplement the research findings.

This study is guided by the Explanatory research design. The relevant population strata for the study are the brokerage firms and Investment banks in the Nairobi City County as well as Managers at the NSE. This population of study was selected after a thorough analysis of the data collection instrument. The Simple Random technique was used to select a sample of study. Both Primary and Secondary data was used during the study. Close ended questionnaires and face to face interviews were used in the facilitation of collection of Primary data, while Secondary data were collected from journal articles on the NSE.

The findings of this study show that, systems at the NSE need to be progressively improved in tandem with technological advancements that are taking place at the world leading securities exchange like the New York Stock exchange or the London Stock exchange among others.

The study concludes that the average numbers of transactions that are processed daily at the NSE are dependent on the ease of access to technology systems. This implies that for the number of transactions to increase the access to technology systems (improved by technological advancements) has to be made better.

The study recommends that progressive technology of trading systems have to be aggressively altered and improved to be able to accommodate increasing numbers and changing needs of traders at the NSE. Furthermore, to improve efficiency and effectiveness of the NSE, aggressive training to the general public is essential to inform them of the progressive technologies being introduced at the NSE.
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DEDICATION

I dedicate this project to my family and fellow students.
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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

The term “exchange” means any organization, association, or group of persons, whether incorporated or unincorporated, which constitutes, maintains, or provides a market place or facilities for bringing together purchasers and sellers of securities or for otherwise performing with respect to securities the functions commonly performed by a stock exchange as that term is generally understood, and includes the market place and the market facilities maintained by such exchange (Securities Exchange Act, 1934). Moreover, Securities Exchange usually involves trading of stocks, bonds and foreign exchange.

It offers a world class trading facility for local and international investors looking to gain exposure to Kenya and Africa’s economic growth. The NSE is the principal bourse in Kenya, offering an automated platform for the listing and trading of multiple securities. NSE is playing a vital role in the growth of Kenya’s economy by encouraging savings and investments, as well as helping local and international companies to access cost-effective capital (NSE Company Profile, 2015).

Investment however, is projected as the current commitment of funds to a risk exposure for a period of time aiming to generate a return. The first task in investment planning is to identify and specify the investor’s objectives and constraints. Investment objectives are desired investment outcomes. In investments, objectives chiefly pertain to return and risk, however, the investment process involves constraints which are defined by Kiremi (2012) as limitations on the investor’s ability to take full or partial advantage of particular investments.

The London Stock Exchange Group is a diversified international exchange Group that sits at the heart of the world's financial community. According to Omuchesi, Bosire, and Mwaura (2014), the Group operates a broad range of international equity, bond and derivatives markets, including: London Stock Exchange; Borsa Italiana; MTS, Europe's leading fixed income market; and the Pan-European equities and derivatives platform, Turquoise. Through its markets, the Group offers international businesses and investors, unrivalled access to Europe's capital markets.
MilleniumIT, (2014) states that, Post trade and risk management services are a significant part of the Group's business operations. LSEG operates CC&G, the Rome headquartered CCP and Monte Titoli, the significant European settlement business, selected as a first wave T2S participant. The Group is also a majority owner of leading multi-asset global CCP, LCH.Clearnet. The Group offers its customers an extensive range of real-time and reference data products, including Sedol, Unavista, Proquote and RNS, as well as access to over 200,000 international equity, bond and alternative asset class indices, through LSEG's world leading index provider, FTSE.

London Stock Exchange Group is also a leading developer of high performance trading platforms and capital markets software. In addition to the Group's own markets, over 40 other organizations and exchanges around the world use the Group's Millennium IT trading, surveillance and post trade technology. Headquartered in London, United Kingdom with significant operations in Italy, France, North America and Sri Lanka, the Group employs approximately 2,800 people (MilleniumIT, 2014).

Trading at approximately 1.46 billion shares each day, the New York Stock Exchange (NYSE) is the leading stock exchange in the world. The exchange trades stocks for some 2,800 companies, ranging from blue chips to new high-growth companies. Each listed company has to meet strict requirements, as the NYSE strives to maintain its reputation of trading strong, high-quality securities (ADVN, 2015).

ADVN, (2015) suggests that, operating as a continuous auction floor trading stock exchange, the major players on the floor of the New York Stock Exchange are specialists and brokers. Brokers are employed by investment firms and trade either on behalf of their firm's clients or the firm. The broker moves around the floor, bringing 'buy and sell' orders to the specialists. Each specialist stands in one location on the floor and deals in one or several specific stocks, depending on their trading volume. The specialist's job is to accept 'buy and sell' orders from brokers and manage the actual auction. It is also the specialist's job to ensure that there is a market for their specified stocks at all times, meaning that they must invest their own firm's capital at times to keep the market active and maintain the shares' liquidity. Specialists and brokers interact to create an effective system that provides investors with competitive prices based on supply and demand.
Hybrid Market expands automated electronic execution and lowers the execution time for market orders from over 10 seconds to less than one second. Because the NYSE’s pre-existing automated electronic execution was fully anonymous and did not allow traders on the NYSE’s trading floor a last-mover advantage, the Hybrid introduction also expands those features. Our analysis examines theoretical predictions of how speed and automation may affect the cost of immediacy (transaction costs for market orders) and price discovery in limit order books and in markets with dedicated market makers (specialists at the NYSE) (Hendershott & Moulton, 2011).

Hendershott & Moulton (2011), state that, Hybrid’s introduction reduces the floor’s advantages by increasing the anonymity of non-floor orders and decreasing the floor’s last-mover advantage. Hybrid’s expansion of automated trading also provides faster feedback in terms of more up-to-date trades and quotes. These direct changes could also introduce indirect changes such as an increase in the working of orders and changes in non-floor traders’ patience, arrival rate, and incentives to acquire information. Immediate automated execution eliminates floor traders’ (specialists and floor brokers on the NYSE) last-mover advantage via their ability to condition their actions on incoming orders (e.g., to observe the identity of broker submitting the order, the price and size of the order, and the state of the limit order book before deciding whether to trade with the incoming order). Anonymity and faster execution also facilitates the breaking of large orders into smaller pieces for execution, a strategy referred to as working an order.

Back & Baruch (2007) show theoretically that large traders work their orders to hide their true demand by pooling with smaller traders. When all orders are worked, floor traders have no information advantage over traders in the limit order book, because floor traders cannot condition their trading decisions on the (unobserved) true demand underlying a market order. The increase in anonymity and speed in the Hybrid Market should increase the working of orders, reducing the information advantage of floor traders. This should result in smaller trades, lower floor participation, and less favourable trades for floor traders.

The JSE was formed in 1887 during the first South African gold rush. Following the first legislation covering financial markets in 1947, the JSE joined the World Federation of Exchanges in 1963 and upgraded to an electronic trading system in the early 1990s. The bourse demutualized and listed on its own exchange in 2005.
The Johannesburg Stock Exchange (“JSE”) offers secure, efficient primary and secondary capital markets across a diverse range of securities, supported by our post-trade and regulatory services. We are the market of choice for local and international investors looking to gain exposure to the leading capital markets in South Africa and the broader African continent. The JSE is currently ranked the 19th largest stock exchange in the world by market capitalization and the largest exchange in the African continent (Johannesburg Stock Exchange, 2016).

In 2003, an alternative exchange, AltX., was launched in Johannesburg for small and mid-sized listings, followed by the Yield X for interest rate and currency instruments. The JSE then acquired the South African Futures Exchange (SAFEX) in 2001 and the Bond Exchange of South Africa (BESA) in 2009. Today it offers five financial markets namely Equities and Bonds as well as Financial, Commodity and Interest Rate Derivatives.

The JSE has undertaken major technological upgrades over the past few years on a consistent drive to upgrade trading, clearing and settlement which is still continuing. In July 2013, the JSE implemented a new trading platform the Millennium Exchange in the Equity Market, while at the same time moving the trading system from London to Johannesburg. Following this successful transition, trades can now be executed up to 400 times faster than under the previous TradElect system. The change allows for increased liquidity and more algorithmic traders.

The Nairobi Securities Exchange Online trading was implemented in 2006. Traders can access the portals through their respective stock brokers. The markets are however, not as efficient as compared to the foreign, LSE, NYSE and JSE. Trading takes place and the prices are not reflected immediately. The access to investor funds is also not instant, which does not provide instant cash flow and liquidity that is required to continue trading.

1.2 Statement of the problem

An automated securities trading system is one where trading is conducted by a network of computers connected to a trading engine, and where brokers simply enter, using a computer, the volume they want to trade and their preferred price (Jallow, 2009). The computer then processes the various offers and bid prices and determines the best price at which the trade
should be executed. The computer accordingly matches the orders and allocates them in order of programmed priorities for trade execution.

In a generation where online shopping is gaining ground, shopping for stocks, bonds and foreign currencies should also be accessible at the touch of a button. Some brokerage firms provide their clients with access to the order book as well as allowing them to submit orders remotely, through an online trading system (Kariuki & Onyuma, 2012).

The efficient market hypothesis (EMH) championed by Fama (1965) forms the cornerstone of modern finance. When the market is efficient, all available information is fully and instantaneously reflected in price, and therefore investors can make informed decisions (Okumu, 2013). This begs the question on whether or not there is integration of progressive technology within the systems of the NSE.

Hendershott & Moulton (2011) have expressed progressive technology within securities exchange as the systems, resources as well as the machines that are applied within the security exchange systems and that are used to improve the efficiency of those securities exchanges.

Despite the introduction of automated trading systems, there still exist malpractices that compromise the objectives of these systems. It is therefore important to examine the challenges affecting the use of automated trading systems in the quest to readdress the professional practices that arise from the use of Automated trading systems (Chepngetich, 2015). There is therefore the need to explore the impacts of progressive technologies within the NSE in particular.

1.3 Purpose of the Study

The purpose of the study is to determine the relevance of progressive technology at the Nairobi Securities Exchange.

1.4 Research Questions

Specifically, the study seeks:

1.4.1 To assess the technology systems currently in use at the NSE.

1.4.2 To determine the factors affecting technological advancements at the NSE.
1.4.3 To analyze the technology systems in place at leading securities exchanges worldwide, to supplement the research findings.

1.5 Significance
The importance of this research study has been explained in terms of how it positively impacts the policy makers of Kenya and how it impacts the researcher as explained below.

1.5.1 Policy Makers
In the Kenyan market, the Policy makers are the Capital Markets Authority who regulates the happenings at the Nairobi Securities Exchange. The research findings would be important to them as it will have provided possible ways in which they can easily monitor the trading without having to get manual documents for follow up. The market and traders were easily accessible and monitored online at the touch of a button.

The CMA’s goal with NSE is to enhance competition between markets. By allowing faster markets to ignore slower markets’ quotes, NSE’s Order Protection (trade-through) Rule effectively precludes traditional floor trading because human interaction is too slow. The laudable goals of NSE are to “give investors, particularly retail investors, greater confidence that they were treated fairly when they participated in the equity markets” and to “promote deep and stable markets that minimize investor transaction costs,” (SEC, 2005). Increasing the speed of execution and the efficiency of prices likely gives investors greater confidence of fair treatment, but the move to faster electronic trading raises the cost of immediacy via adverse selection (Hendershott & Moulton, 2011).

1.5.2 Researchers
This document provided researchers with information on the current position of the NSE and the level that has been reached towards improving the efficiency and immediacy of its trading. Researchers can further make recommendations based on the level of Technological Advancement that would have been reached at their period of research from the level that has currently been attained.
1.6 Scope of the Study

The study focused on research in the Nairobi Region. This was limited due to existence of the Securities Exchange only being present in Nairobi. The population of the study included the Managers at the NSE, the Stock brokers and Investment Banks. The study was estimated to be completed within a period of 12 weeks.

1.7 Terminologies

A Hybrid Market expands automated electronic execution and lowers the execution time for market orders from over ten seconds to less than one second (Hendershott & Moulton, 2011). Efficiency in markets is remarkably efficient when there is low noise trade or when it is likely that securities’ payoffs will be equal to their fundamental values (Tetlock, 2006).

Immediacy involves the direct execution of orders and instant access of investor funds.

1.8 Chapter Summary

An efficient market creates ease of accessibility for traders and hence an increase in the overall number of transactions per day. With the introduction of progressive technology systems at the Nairobi Securities Exchange, opportunities for International traders is created and hence an improvement in the overall economy of the country.

There is a gap in the current services being offered, with the transactions not being reflected immediately after trading at the stock brokers and Investment Banks. Therefore, the picture painted of the market happenings is inaccurate. There is a need to have the brokers’ transactions, reflected immediately at the overall markets, to create a true picture of the company’s trading portfolio.

Chapter 2 will provide a Literature Review on how efficiency, accessibility and immediacy can be achieved. Further, Chapter 3, will guide on how the study will be conducted and the tools required. Chapter 4 will provide information on the technological advancements in the efficient markets and the actual integration process that needs to be integrated into the NSE. Chapter 5 will carry out analysis based on information gathered from chapter 4 and draw conclusions on possible steps that can be taken to make these improvements a reality. Recommendations for further study will also be included in that section.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction
This study sought to assess the technology systems currently at the NSE, how they operate and how they can be progressively improved to ensure efficiency, reliability and immediacy, in comparison to leading stock exchanges from around the globe. The study also sought to determine the factors that affect technological advancements at the NSE. Furthermore, the study looked at the technology systems in place at leading stock exchanges worldwide, with a view of providing the NSE with recommendations for requisite improvements. The study collected data from local brokers, Investment Banks and NSE managers, as well as journals from leading stock exchanges worldwide.

2.2 Technology systems currently in place at the NSE.
The Nairobi Securities Exchange (NSE) is a leading African Exchange, based in Kenya one of the fastest-growing economies in Sub-Saharan Africa. Founded in 1954, NSE has a six-decade heritage in listing equity and debt securities. It offers a world class trading facility for local and international investors looking to gain exposure to Kenya and Africa’s economic growth (NSE Company Profile, 2016).

The Automated Trading System (ATS) was introduced in September 2006 in a bid to improve trading and general market efficiency. This saw the number of trading hours in a day increase by two to three hours. The trading of rights issues also started trading in the same manner as stocks, with the ATS also enabling the trading of corporate and treasury bonds. Later that year, a Memorandum of Understanding (MOU) between the Nairobi and Ugandan Securities exchanges allowed the cross listing of securities across the two exchanges (Kamau, 2013).

The NSE is one of the active capital markets in Africa, sub-Saharan Africa's fourth largest bourse with 58 listed companies and 24 brokerage firms (Onyuma & Mugo, 2012). NSE reclassified the industry sectors under which listed companies are placed. This reclassification brings NSE closer to international best practice and will enable domestic and international investors to more easily compare company and sector performance. NSE’s Vision is “To be a leading securities exchange in Africa, with a global reach” (NSE, 2013).
The performance of a stock market of an economy is of interest to various parties including investors, capital markets, the stock exchange and government among others. There is evidence that stock markets promote economic growth in Africa (Yartey & Adjasi, 2007). They find that stock markets contribute to financing corporate investments and growth of listed firms in Africa i.e. stock markets impact aggregate economic performance through corporate financing. The implementation of the Automated Trading System (ATS) was a key to achieving enhanced operational efficiency, transparency, reduced cost of doing business, and enhanced market integrity and investor confidence (Capital Markets Authority, 2007).

NSE demutualized and self-listed in 2014. Its Board and management team are comprised of some of Africa’s leading capital markets professionals, who are focused on innovation, diversification and operational excellence in the Exchange. NSE is playing a vital role in the growth of Kenya’s economy by encouraging savings and investment, as well as helping local and international companies’ access cost-effective capital. NSE operates under the jurisdiction of the Capital Markets Authority of Kenya. It is an affiliate of the World Federation of Exchange, a founder member of the African Securities Exchanges Association (ASEA) and the East African Securities Exchanges Association (EASEA). The NSE is a member of the Association of Futures Market and is a partner exchange in the United Nations-led SSE initiative (NSE Company Profile, 2016).

2.2.1 Automation

In September 2006 live trading on the automated trading systems of the NSE was implemented. The ATS was sourced from Millennium Information Technologies (MIT) of Colombo, Sri Lanka, who is also the supplier of the Central Depository System (CDS). MIT have also supplied similar solutions to the Colombo Stock Exchange and the Stock Exchange of Mauritius. The NSE ATS solution was customized to uphold the spirit of the Open Outcry Trading Rules in an automated environment (NSE, 2016).

A Wide Area Network (WAN) platform was implemented in 2007 and this eradicated the need for brokers to send their staff (dealers) to the trading floor to conduct business. Trading is now mainly conducted from the brokers’ offices through the WAN. However, brokers under certain circumstances can still conduct trading from the floor of the NSE (NSE, 2016).

In 2008, the NSE All Share Index (NASI) was introduced as an alternative index. Its measure is an overall indicator of market performance. The Index incorporates all the traded shares of
the day. Its attention is therefore on the overall market capitalization rather than the price movements of select counters. The NSE marked the first day of automated trading in government bonds through the Automated Trading System (ATS) in November 2009. The automated trading in government bonds marked a significant step in the efforts by the NSE and CBK towards creating depth in the capital markets by providing the necessary liquidity. Also in 2009, NSE launched the Complaints Handling Unit (CHU) SMS System to make it easier for investors and the general public to forward any queries or complaints to NSE (NSE, 2016).

In October 2011, the Broker Back Office commenced operations. The system has the capability to facilitate internet trading which improved the integrity of the Exchange trading systems and facilitates greater access to our securities market.

The Nairobi Securities Exchange launched a new system for trading corporate bonds and Government of Kenya Treasury Bonds allowing on-line trading of debt securities and is integrated with the settlement system at the Central Bank of Kenya. The system is more efficient, scalable and flexible, and can support trading in bonds that have been issued in foreign currencies (NSE, 2016).

2.2.2 Automation Effect

Muli, (2008) examined the relationship between Electronic Trading and Stock Market Efficiency at the NSE and found out that the automated trading system brought about reduction in fraud, increased overall market efficiency and reduction in transaction cost and that the efficiency of the stock/securities market is based on fraud detection, efficiency in price reporting and regulation of market. In overall terms she found significance relationship between electronic trading and stock market efficiency. Market efficiency asserts that NSE is weak form efficient (Michoki, 2013).

In a study on the perceived benefits and limitations of the automated trading systems at the NSE, Kirema (2013) indicated that the introduction of ATS at NSE had increase market liquidity, reduced time taken to execute trade, lowered trading costs and standardized NSE to international market standards. The study however established that ATS had brought several limitations including difficult auditing transactions, unethical practices, unauthorized trading in clients shares among others. The integrity and the professionalism of the market players
were put into question with recommendations made to put in place stringent regulatory framework (Chepngetich, 2015).

2.3 Factors affecting technological advancements at the NSE

Yartey & Adjasi, (2007), express that the online trading only seems to be available through the help of stock brokers. If this could be eased such that, one could easily access the securities through the main NSE website, make payments and transact without the brokers, this would be fast and convenient. Pay-out of cash after transacting also takes time. Instant cash flow would make the traders maintain their cash flow at all times. With the availability of mobile money and online trading for banks, trading can be easily completed at the comfort of your desk.

Lo (2005) additionally explains that studies done on weak form market efficiency have resulted into adopting a fixed approach when testing for efficiency levels, which results into the conclusion that a market is weak form efficient or inefficient. This tends to ignore the environmental factors that may influence market efficiency. According to the AME championed by, market efficiency is highly context dependant as influenced by Environmental factors such as regulatory changes, microstructure improvement and the number of market participants. As a result, the efficiency of a securities market may change as influenced by these environmental factors. Thus, a more appropriate way to look at market efficiency would be whether the market is becoming more efficient as a result of these factors rather than concluding that a securities market is weak form efficient or inefficient. An efficient market would also be crucial, such that price changes are randomly generated at any one particular point in time (Gakeri, 2012).

2.3.1 Automation tendencies in the stock market

Omuchesi & Bosire (2014) found that stock exchange automation is noted as being on the rise in the African continent. This can be seen through the Johannesburg stock exchange automation in the mid-1990s as well as in the Egyptian stock exchange automation driven under order during the 1992 and more automation is in progress. The sub Saharan Africa’s stock exchanges over the years have gradually adopted electronic systems, however, a large section of the countries in Africa still rely on the manual driven trading system and manual settlement and clearing systems. African countries such as Botswana, Zimbabwe, Rwanda,
and Uganda have currently followed the automation trend in Africa as per African Capital Markets News in 4th September, 2014 as cited in the works by the above named authors.

2.3.2 Volatility in stock market price

Omuchesi & Bosire (2014) further established that trading system automation conducted under computerized system of trading is deemed as much less costly and as a faster means of trading. Traders in the trading system have ease of accessibility to a wider scope of information and bid as well as access prices, trade volume and size, at a minimal cost as a result of availability of limited space in order book as compared to operations under systems that limits data accessibility on standing orders as well as under the market. This will therefore, lure more investors while enhancing the liquidity, volume, and create attractive price invention in the market. On the contrary, opponents of automation of the trade systems presented that, electronic system of trading may result to minimal effective prices due to the fact that predictive element in trade execution diminishes with inception of automation, an element which is essential specifically during fast shift in market operations.

Naidu & Rozeff (1994), suggest that volatility in the market is probably likely to increase where automation is an enhancer to disseminating prices especially where price occurs in the market. Reduced auto returns correlations result in improvement of market efficiency as reflected in Singapore’s Stock Exchange. Moreover, the stock market prices increase while the market liquidity improves and the equity capital cost automatically declines globally due to increase in shift in transparency via the computerized trading system (Domowitz & Steil 2001, Muscarella & Piwowar 2001).

However, transformation of the market system to involve electronic system of trading has increased volatility with no substantial impact on the efficiency in the market operations (Maghyereh, 2005). Al-Khouri & Al-Ghazawi (2008) notes that the Amman stock market (ASE) reflected volatility reduction after the institution had adopted the electronic trading system with enhanced liquidity standards. On the contrary, the automation process of the Tunisia’s Stock Exchange (TSE) did not result to significant change in the market volatility (Sioud & Hmaied, 2003).

Toronto’s Stock Exchange (TSE) is believed to have increased its volatility with the introduction of electronic trading thus impacting positive security pricing in the exchange.
market. The transformation in the volatility structure as well as relationship in risk return led to increase in the level of information streaming in market in the post automation. However, mixed evidence has been reflected on the impact of automation on the trading floor or without a trading floor. Venkataraman (2001) make a comparison of the New York Stock Exchange (NYSE) which possesses a trading floor and the Euronext Paris which is has full screen in stock operations.

The reflection presented by Venkataraman (2001), is that the floor based system of exchange has a lower spread as compared to the electronic trading system which possessed a long term advantage in the trading. Moreover, a shift in the stock exchange globally from floor systems to electronic system of trading had several effects on long term advantageous impact experienced through significant reduction in equity premium in the post implementation of electronic trading. This as well impacted on the listed firm’s cost which declined while there was an increase in the monthly transaction turnover thus reducing the liquidity ratio in the stock market (Jaine, 2005). Jarnecic and Snape (2010) relates that London Stock Exchange (LSE) realized that HFT enhanced liquidity thus was probably not able to increase volatility. In this perspective, Murinde (2014) notes that the year 1999 in African trade in capital market experienced transformation which improved efficiency in Nigeria stock Market(NSE), Nairobi Stock market (NSE), Johannesburg stock market (JSE) and enhanced market liquidity while reducing the rate of volatility in the market.

Pagano & Roelle (1996) presents a comparative analysis on price and liquidity formation processes involved in diverse trading systems and involves diverse transparency levels. According to Pagano & Roelle (1996) transparency can be defined as the likelihood to uphold the direction and size of opportunities preference in exploiting the least informed members, an element which will likely reduce the pricing, volatility, and the spread error in trading. However, Mahajan, Porter & Weaver (2002), believe that excess transparency as per pre-trade analysis report is detrimental to trade, hence, discovery of an efficient price process is linked conventionally to reduced essential volatility which enhances effectiveness in stock market resource allocation. Therefore, risk opposed investors are likely to demand an increased premium risk levels which in return increases capital cost while minimizing liquidity in trading (Kim & Singal, 2000).
The effect of change in microstructure on market competence at the NSE-Nairobi stock exchange can be reflected in the technology introduction at the stock exchange resulting in increased efficiency in the market. The result presented in automation of NSE is that there was a higher return in the mean market after implementation of technology run market and the more volatile as compared to the period before automation implementation. Okumu (2013) notes that increase in market returns could have been impacted by improved innovative process on price while increase level of volatility might have been caused by transformation in the market microstructure via the systems of trading.

The performance of the African stock markets has been met with enthusiasm commensurate with the solutions formulated and implemented in contemporary challenges. This research report tries to establish whether the belief that automation of markets does not guarantee positive expansion in the volatility of markets.

As de la Torre & Schmukler (2006) note, privatization and liberalization programs on the stock market through the institutional and security markets reforms can significantly contribute in performance of stock markets. These elements of privatization, liberalization, and reforms were reflected in Kenya in the 1990s (Maehle, Teferra & Khachatryan 2013). The contention of Maehle et al., (2013) had previously been explained by Jefferis & Smith (2005) who noted that the Kenya security market experienced an increase in operations as from 1993 period due to implementing privatization measures, relaxing or removal of restraining factors in exchange control and to foreign investors, and economic reforms.

However, the consistency in economic reforms implementation has been halted with political challenges turning out to be a factor in market volatility with focus in markets pegged on dollar. The analysis focuses on managing intervening variables such as privatization. This study will therefore concentrate on data from any listed equity security by the period 2002 as the variables in question had already been put into test prior to its impact thus its impact was reflected by comparing it with the period before automation.

2.4 Technology systems in place at leading securities exchanges worldwide.

2.4.1 Automation and security trading

The frequency of trading at the securities exchange will determine the importance of an accessible and reliable online trading platform. According to de la Torre and Schmukler, (2006), brokerage involves bringing together buyers and sellers, facilitating trades through
the maintenance of a marketplace, and assuring that the trade is complete. The significance of this activity as part of the operations of the securities industry cannot be overestimated. Traditionally, all of the costs of supporting an investment bank or brokerage house were recovered through this portion of the business. The services provided to clients, such as research support and advice, were bundled into the commission rate for purchasers of securities and into the spread on new issues for investment banks. The heart of brokerage with retail clients has been personal selling. The relationship between the investor and the individual broker has been fairly constant, and typically, the accounts a registered representative develops while with a particular brokerage house move with him if he/she switches firms. Firms within the industry have expended great effort in attempts to retain clients (de la Torre and Schmukler, 2006).

The development of new products unique to particular houses may encourage a loyalty to the company rather than to the broker. It is not yet clear how this might change the character of the industry. Most technology encouraged competition is occurring within the selling function of retail and institutional brokerage. The end of standardized commissions on the sale of securities (1975) has encouraged the entrance of discounters into this market. Discount brokers complete trades for investors at prices that are generally lower than the commission charged by full-service brokers. Usually, the service provided by discounters is limited; e.g., these firms usually do not support extensive research and advice operations. However, they do fill the needs of a portion of the market. About 15 percent of trading by individual investors is handled by discounters. Access to information technology for individuals will facilitate direct selling of securities to investors without the interaction of a broker. This type of system is particularly adaptable for discount brokers whose service is basically order-taking. C. D. Anderson & Go., a small discount broker, developed the first home brokerage system, and other brokerage houses are expected to enter this market. C. D. Anderson’s system allows clients, who pay a hook-up charge and a usage charge, to enter buy and sell orders at their convenience, without dealing with a broker (NYSE, Fact Book, 1983).

The central asset account is considered by many to be the single most important investment product of the next decade. In developing the market leading Cash Management Account, Merrill Lynch recognized that the financial needs of a single customer are inter-related and
form well-defined types of systems. The central asset account attempts to meet an investor’s full range of financial needs with three basic components: the securities margin account, the money market fund account, and a zero-balance bank loan account that can be accessed by cheque or card (de la Torre and Schmukler, 2006). A central asset account provides a full range of financial services to its user. The accounts offer a centralized method of controlling assets and, as free credit balances in the zero-balance account are “swept” into a money market fund, both liquidity and return are maximized for the investor (NYSE, Fact Book, 1983).

Nearly all major securities firms offer a central asset account. While they have the same basic components, their features often differ. Among the features that distinguish accounts are: how frequently “sweeps” of free credit balances occur, whether a charge or debit card is issued for access, the offering of excess insurance coverage; whether the account is accessible through an ATM network, and the availability of a bank overdraft line of credit. The accounts have been targeted toward the upscale market, an estimated 10 to 12 percent of the population. A substantial minimum opening deposit of securities or cash, usually of between $15,000 and $20,000, is required and an annual fee is charged (NYSE, Fact Book, 1983).

Clearance and settlement activities consummate trades through the exchange of securities and funds. As with any marketplace, an action recognizable to all parties involved is necessary for finalizing a transaction. Given the great number of participants in the securities industry, it is essential that transactions be closed as efficiently as possible in a manner that is acceptable to all parties involved (OTA-CIT-202, 1984).

The increasing volume of trade and the continuing development of new securities products have made it necessary to refine settlement and clearance. Since ownership is merely contractual until the process is finalized, delays in settlement and clearance could have a severe effect on the operation of securities markets. An industry wide effort is under way to move toward a national settlement and clearance procedure through the adoption of standardized proofs of ownership that are not paper based, such as book entry, and to facilitate effective, market wide clearance through the use of automated systems that assist in the closing of positions (OTA-CIT-202, 1984).
2.4.2 Options Market in Leading Stocks Exchanges

Options provide a method of participating in a securities market without ownership of actual debt or equity instruments. An option is a tradable instrument that grants an investor the right to buy (a call option) or the right to sell (a put option) a specific security at a given price for a limited amount of time. It is a legal contract in which two factors are explicitly stated: the expiration date and the exercise price. The value of an option is directly related to the market price of the underlying security. The exercise price of an option indicates the change anticipated in the market. The exercise price of a call option (at which the investor can buy the underlying security) is, at the time the option is issued, generally higher than the market price of the security. Conversely, the exercise price of a put option, which entitles the holder to sell the security, is generally lower than the market price. Options may be written and sold for real estate, debt instruments, and foreign currencies; they have recently become most significant in equity markets. Options are “wasting assets”; that is, after the specified expiration date, they have no value. Therefore, the timing of market changes, as well as direction, must be correctly evaluated by the investor to assure that the potential value of the investment is realized. The writer of an option, except for warrants, which are discussed below, is not controlled by the organization named in the underlying security. More shares of stock may be represented collectively through outstanding options than have been issued by the corporation. While option writing and buying may be part of a complex investment portfolio that includes debt and equity instruments of an institution, the operations of option markets are, in a practical sense at least, totally separate from the capital structure of a corporation. While options have been traded among individuals for many years, the market has grown and become more sophisticated since the organization of regulated exchanges in the mid-1970’s. The trading of options entails a relatively new market structure; therefore, the influence of information technology on this structure is quite visible. For example, options use book entry rather than certificates as proof of ownership (Securities Industry Automation Corp., 1982).

Information technology is likely to continue to facilitate the development and trading of options. Because option markets have only recently become highly structured and have been heavily dependent on technology from their inception, the continuing application of communications and computer technologies in these markets is not likely to lead to major
revisions in ways of doing business to the same extent as they have in debt and equity markets. Options may serve as a testing ground of sorts for new technologies, and technology use in this area may presage future applications throughout the securities industry. The use of personal computers and sophisticated communications technologies may spur the development and marketing of option contracts by individuals and may lessen the role of brokers in bringing writers and buyers together. Information technology should also facilitate the monitoring of option markets by investors, brokers, corporations issuing securities on which options are written, and market observers and regulators. This may become increasingly important as the use of options as an investment instrument grows. Full-service brokerage houses perform trades in securities and commodities and provide financial counselling services supported by in depth research and analysis of markets and industries. This segment of the industry is dominated by firms which are subsidiaries of companies that offer a range of financial management services. While brokerage houses in the past competed on the reputation of their research and the quality of their service, price competition has also become a factor. Discounters, who concentrate on the transaction side of the business, have entered the market and have attracted a significant portion of both institutional and individual trading. In response to this market entrance, many full service brokerage houses are taking steps to distinguish their services and to increase client loyalty. Increased efforts are being directed toward product development and promotion. The demands and characteristics of users of the industry are major determinants of industry structure. The organizations of the securities industry serve as intermediaries between two sets of users: capital seekers and investors (Securities Industry Automation Corp., 1982).

2.5 Chapter Summary

This chapter reviewed information from the previous works on the questions of this research. From the reviewed information, it has been established that previous works of research concur with the research questions of this research.

Chapter three will look at the data collection methods and explain how information will be gathered and the sources that are relevant.

Chapter 4 will provide analysis on information gathered. Chapter 5 will discuss findings from chapter 4, draw conclusions and provide recommendations for further study.
CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction
Research is a logical and systematic search for new and useful information on a particular topic. It is also described, as an investigation of finding solutions to scientific and social problems through objective and systematic analysis. It is a search for knowledge, that is, a discovery of hidden truths. Here knowledge means information about matter. The information might be collected from different sources like experience, human beings, books, journals, nature etc. A research can lead to new contributions to the existing knowledge. Only through research is it possible to make progress in a field. Research is indeed civilization and determines the economic, social and political development of a nation. The results of scientific research very often force a change in the philosophical view of problems which extend far beyond the restricted domain of science itself.

3.2 Research Design
Research design is the research process that involves the overall assumptions of the research to the method of data collection and analysis (Shaw, 1999). The research design to be used in this study is Explanatory Research Design.

Zikmund (1984) suggests that the degree of uncertainty about the research problem determines the research methodology. The nature of progressive technology systems in use at the NSE is not out rightly known, and hence this research seeks to find out how these can be made accessible and brought closer to the traders. The main objective of this study is to determine the relevance of progressive technology at the Nairobi Securities Exchange.

3.3 Population and Sampling

3.3.1 Population
A population distribution is a statement of the frequency with which the units of analysis or cases that together make up a population are observed or are expected to be observed in the various classes or categories that make up a variable (Watt and Berg 2002). The population is composed of a homogenous group of individual with unique elements from one another that permits them to be grouped as sample for the study.
The population where the sample will be extracted will include the Nairobi Securities Exchange managers, investment banks and stock brokerage firms in Nairobi.

3.3.2 Sampling Design

Sampling involves selecting some of the elements in a population from which, conclusions may be drawn about the entire population (Cooper and Schindler 2014).

The sample will be picked from stock brokerage firms in Nairobi, as well as managers at the NSE and investment banks. The leading securities exchanges were also used to compare the sample secondary data on how the local, Nairobi Securities Exchange, can be improved. The level of technological advancement was considered since it provides for the efficiency and reliability in the trading process.

3.3.2.1 Sampling Frame

A sampling frame, as noted by Cooper and Schindler (2014), is the list of elements from which the sample is actually drawn and it is composed of a complete and correct list of population members only.

The sample included Managers from the NSE, who are well endowed with information on trading, Investment Banks, securities brokers based in Nairobi and secondary data from the leading stock exchanges worldwide.

3.3.2.2 Sampling Technique

Mugenda (1998) stated that a sampling technique is a method used to determine how the population of the study was selected based on the information that will be required and the specification required in the study by the researcher.

In this study, simple random sampling was used to select the sample from which to collect data from. The respondents were selected randomly to avoid bias and in order for reliable responses to be collected.

3.3.2.3 Sample Size

A sample size is the number of instruments or observations to be used in a research. The sample size consisted of a total of 40 respondents, from Investment Banks, Stock brokers and
NSE Managers, based in Nairobi, who gave their references on trading at the NSE and at the leading stock exchanges.

3.4 Data Collection

According to Judith (2003), data collection plan specifies the details of the task, such as when, how, who, what and where?

Information was collected by issuing questionnaires to managers at the NSE, stock brokers and Investment banks. Interviews were also conducted on the NSE managers at the head office in Westlands. Information was also collected from journals on trading at the leading stock exchanges in order to compare with trading at the NSE. Grouping of the data ensured accuracy and consistency. Secondary data was essential in the study as this made a comparative analysis of various stock markets to come up with a more realistic conclusion deduced from stock exchanges with maximum efficiency, high number of transactions and automated, with the NSE.

3.5 Research Procedure

A research procedure explains how research will be carried out. In this study the research involved constructing questionnaires to be used to source data from the relevant populations on how trading at the securities exchange is conducted.

The questionnaire was divided into sections so as to aid in the ease of getting responses from the interviewed sample space. These sections were mainly three sections which were divided to ensure that there was flow of information.

The questionnaires comprised of demographic characteristics; which presented the bio-data of the participants thus presenting elements such as age, gender, salary, trading experience, and position at work. The second section of the study captured the first objective of the study, to gather information on the technology systems currently in place at the NSE. The third part captured the second objective with the aim to determine the factors affecting technology systems advancements at the NSE. The last section of the questionnaire evaluated the technology systems at leading securities exchanges worldwide in order to supplement the research findings which summarize the third objective.
Further research was carried out by getting journals of selected securities and stocks markets to understand the systems in place, processes and procedures that make their market to be deemed most efficient.

This information was then collected, sorted and analysed in order to draw conclusions from it and to find out the relevance of carrying on further research or make inferences out of it.

3.6 Data Analysis
Data collected will be sorted and organized into useable form. Analysis will be conducted to identify possible typos, missing data, to re-align the variables and to transpose the data.

Data will be organized using SPSS version 21 as well as the Microsoft Excel to make sense out of it through graphs, tables and charts explaining the data trends. Moreover, coding was necessary in the process of the study so as to ensure confidentiality of the participants who feared being threatened by being involved in the process of the study.

3.7 Chapter Summary
This chapter gave a brief on how research was carried out, the tools, procedures and the resources required to carry out the research. These are the devices necessary to make the study effective and reliable and helped in coming up with findings necessary for discussions and deduction of conclusion and recommendations for the study.

Chapters 4 and 5 will provide the actual information on the research with analysis and a summary of the findings and recommendations. It is expected that understanding the trading at the foreign markets provided an overview on how the local securities can be progressively improved.
CHAPTER FOUR

4.0 RESULTS AND FINDINGS

4.1 Introduction

The objective of this study was to determine the relevance of progressive technology at the Nairobi Securities Exchange. The chapter presented and discussed the findings of the study, using 40 respondents that include NSE Managers, Investment Banks and Stock brokers.

The target population comprised of the 40 interviewees from the NSE, stockbrokers and Investment Banks that are recognized and registered by CMA. The additional information used in the creation of the research findings in this study comprised of stock volumes announced by CMA through their Quarterly Statistical Bulletin. Analysis of the data findings was done using Microsoft Excel and SPSS version 21. Excel was used in the data compilation while SPSS was used for final statistical data analysis.

4.2 Research Findings

After the data was collected from the interviewees, the researcher used the above stated software to develop the chart, table and figures that represent the findings for the research project. These findings were divided according to the subsections of the questionnaire used in the research.

4.3 Demographic Characteristics

4.3.1 Gender of Respondents

![Figure 4.1 Gender](image)

Figure 4.1 Gender
Based on the data collected, it was observed that a larger population of the respondents was female. Figure 4.1 above shows the population distribution based on gender. The females represent approximately 60%, while the male population consisted of only 40% of the sample population.

**4.3.1.2 Age of Respondents**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-25yrs</td>
<td>0</td>
</tr>
<tr>
<td>26-35yrs</td>
<td>70.0</td>
</tr>
<tr>
<td>36-45yrs</td>
<td>30.0</td>
</tr>
<tr>
<td>46-55yrs</td>
<td>0</td>
</tr>
<tr>
<td>Above 55</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Table 4.1 Age**

Evidence from the data shows that majority of the population that participates in trading in stock exchanges are those between the ages of 26 to 45yrs. Based on table 4.2 above. It can be observed that 70% of the participants were between the ages of 26-35 years, while the other 30% were between 36-45 years of age.

**4.3.1.3 Salary Range of Respondent**

<table>
<thead>
<tr>
<th>Salary Range</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>50,001-100,000</td>
<td>22.2</td>
</tr>
<tr>
<td>100,001-300,000</td>
<td>44.4</td>
</tr>
<tr>
<td>300,001-500,000</td>
<td>33.3</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Table 4.2 Salary Range**

The income level of the respondents was considered, in order to understand the market participation. The salary range of 22.2% of the respondents was between 50,000 – 100,000, 44.4% was between 100,001 – 300,000 and 33.3% was between 300,001 – 500,000. Majority of the respondents were between 100,001 – 300,000.
4.3.1.4 Job Title of Respondents

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Manager</td>
<td>20.0</td>
</tr>
<tr>
<td>Manager</td>
<td>40.0</td>
</tr>
<tr>
<td>Other</td>
<td>40.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.3 Job Title

The sample of respondents shows that a majority of the respondents were Managers, representing 40% of the population, while 40% representing those in other positions. This shows that there is an equal participation in stocks trading by both the managers and their juniors.

4.3.1.5 Years of Experience in trading

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30.0</td>
</tr>
<tr>
<td>Less than 1 yr.</td>
<td>10.0</td>
</tr>
<tr>
<td>1-3yrs</td>
<td>10.0</td>
</tr>
<tr>
<td>3-5yrs</td>
<td>30.0</td>
</tr>
<tr>
<td>Over 7yrs</td>
<td>20.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.4 Length of trading

The population of respondents sampled with less than a year’s experience of trading was 10%, 1-3 years was 10%, 3-5 years was 30% and 20% of the respondents had participated for over 7 years. Majority of the respondents are seen to have traded at the NSE for between 3 to 5 years. 30% of the respondents chose not to disclose the period they have traded.
4.3.2 Experience with Technology systems currently at the NSE

<table>
<thead>
<tr>
<th>Technology systems at the NSE are efficient</th>
<th>The systems in place are at par with International Standards</th>
<th>The users have understood the systems well</th>
<th>There are minimal challenges with usage of the systems</th>
<th>Transactions happen real time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.40</td>
<td>1.9000</td>
<td>2.2000</td>
<td>2.2000</td>
</tr>
<tr>
<td>Mode</td>
<td>1</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Table 4. 5 NSE Statistics

Respondents Strongly Agree that the Technology systems at the NSE are efficient. They agree that the systems in place at the NSE are at par with International recognized standards. They also agree that the users have understood the systems well, there are minimal challenges with usage of these systems and that transactions at the NSE happen real time.

4.3.2.1 Efficiency of technology systems

![Efficiency of technology systems](image)

Figure 4. 2 Efficiency of technology systems

It was established that 60% of the respondents Strongly Agree that the Technology systems at the NSE are efficient. 40% agree to this.
4.3.2.2 Comparison with International Technology Systems

Figure 4. 3 Technology Systems comparison with International Standards

In comparison to Internationally accepted standards of technology systems, 20% strongly agree that the systems in place at the NSE are at par. It was found out 70% agree while 10% are neutral on the technology systems in place.

4.3.2.3 Technology Systems familiarity

<table>
<thead>
<tr>
<th></th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>30.0</td>
</tr>
<tr>
<td>Agree</td>
<td>40.0</td>
</tr>
<tr>
<td>Neutral</td>
<td>10.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>20.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4. 6 Technology Systems Familiarity

According to 30% of the population, system usage is familiar and they can easily access and use the systems in place for trading. From the findings, 40% agree to this, while 10% are neutral and 20% disagree that they can access the systems easily.
4.3.2.4 System challenges

Figure 4. 4 Technology Systems Challenges

It was established that 20% of the sample population Strongly agree to the fact that there are minimal challenges with usage of the NSE technology systems. It was also found out that 50% agree to this, 20% are neutral while 10% disagree. The study noted that 50% respondents agree that there are minimal challenges with usage of the systems.

4.3.2.5 Real Time Transactions

Figure 4. 5 Real Time Transactions
In regards to the speed of transactions at the NSE, 40% strongly agree that their response is real time, 50% Agree that they are real time, while 10% are neutral on this. It is therefore noted that 50% Agree that transactions happen real time.

4.3.3 Transaction Volumes at the NSE

<table>
<thead>
<tr>
<th></th>
<th>Volume of Daily NSE Transactions</th>
<th>Volume of Weekly transactions at the NSE</th>
<th>Volume of Monthly transactions at the NSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.2222</td>
<td>2.5556</td>
<td>3.6667</td>
</tr>
<tr>
<td>Mode</td>
<td>5.00</td>
<td>3.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Table 4.7 Transaction Volumes Statistics

According to this study, over 300,000,000 transactions are traded daily, over 1 Million transactions are traded weekly and over 5 Billion transactions are traded monthly at the NSE.

4.3.4 Speed of Trading

<table>
<thead>
<tr>
<th></th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1min</td>
<td>90.0</td>
</tr>
<tr>
<td>2-5min</td>
<td>10.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.8 Speed of Trading

The average speed of trading was given at 0-1 minutes by 90% of the respondents and 2-5 minutes by 10% of the respondents. Trading at the NSE takes between 0-1 min based on the responses from this study.

4.3.5 Accuracy of Transactions

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.9 Accuracy of Transactions
Transactions at the NSE were seen to be accurate with 100% response in support of this.

4.4 Factors Affecting Technological Advancements at the NSE

4.4.1 Technology systems Changes

<table>
<thead>
<tr>
<th></th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>60.0</td>
</tr>
<tr>
<td>No</td>
<td>40.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4. 10 Technology Systems Changes

The study found out that 60% of the respondents say that there have been technology systems improvements while 40% disagree to this. The staff at the NSE strongly disagreed to this while the Investment Banks and Stock Brokers agreed to this. Though a majority of the respondents are seen to come from the Investment Banks and Stock brokers, and hence the positive response, in actual sense, no changes have been implemented this year.

4.4.2 Experience with Technology Systems at the NSE

<table>
<thead>
<tr>
<th>Technology systems advancements are made regularly</th>
<th>staff at the NSE are conversant with the technology systems in place</th>
<th>Assessment is carried out on the systems before changes are made</th>
<th>Stakeholders are involved in the technology systems change Implementatio n</th>
<th>Regulatory requirements limit technology systems advancements</th>
<th>No challenges experienced once system changes are made</th>
<th>I frequently trade at the NSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.9000</td>
<td>1.5000</td>
<td>1.6000</td>
<td>1.9000</td>
<td>2.6250</td>
<td>3.1111</td>
</tr>
<tr>
<td>Mode</td>
<td>2.00</td>
<td>1.00a</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>3.00</td>
</tr>
</tbody>
</table>

I trade in other stock exchanges

<table>
<thead>
<tr>
<th>I trade in shares</th>
<th>I trade in bonds</th>
<th>My stock broker is reliable</th>
<th>My transactions are processed instantly</th>
<th>Stock prices are readily available</th>
<th>I am able to access my funds instantly</th>
<th>Trading is straight forward with no intermediaries</th>
<th>I would like technology systems to be improved at the NSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5714</td>
<td>1.6250</td>
<td>3.8571</td>
<td>1.4444</td>
<td>1.5000</td>
<td>1.2222</td>
<td>2.6667</td>
<td>2.6250</td>
</tr>
<tr>
<td>5.00</td>
<td>1.00</td>
<td>5.00</td>
<td>1.00a</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 4. 11 Experience with Technology Systems
The respondents agree that technology systems advancements at the NSE are made regularly. They strongly agree that staff working at the NSE are conversant with the technology systems in place at the NSE. They agree that assessment is carried out on the systems before changes are made. The respondents also agree that stakeholders are involved in the technology systems implementation and that regulatory requirements limit advancements. They were neutral on the opinion that no challenges were experienced once system changes were made. Most of the respondents strongly agreed that they frequently trade at the NSE. They strongly disagree that they trade in other stock exchanges other than the NSE. A majority of the respondents strongly agree that they trade in shares and strongly disagree that they trade in bonds. The stock brokers are seen to be reliable as the respondents strongly agree to this. They also strongly agree that their transactions are processed instantly and that the stock prices are readily available. Instant access to funds is relative as the respondents agreed to this, meaning it takes some time before they are given their money. Trading online was observed to be straightforward with no intermediaries and Technology systems need to be improved.

4.5 Technology Systems at Leading Stock Exchanges Worldwide

4.5.1 Leading Stock Exchange

<table>
<thead>
<tr>
<th></th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>NYSE</td>
<td>87.5</td>
</tr>
<tr>
<td>NASDAQ</td>
<td>12.5</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4. 12 Leading Stock Exchange

The leading stock exchange is the NYSE according to 87.5% of the responses. 12.5% believe that NASDAQ is the leading stock exchange.
4.5.2 Transactions Volumes at leading stock Exchanges

<table>
<thead>
<tr>
<th></th>
<th>Daily International transaction numbers</th>
<th>Weekly International transaction numbers</th>
<th>Monthly International transaction numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>3.0000</td>
<td>2.1667</td>
<td>2.5000</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>2.00a</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 4.13 Transaction Volumes Statistics Worldwide

The report shows that majority of the respondents have it that the volumes of daily transactions lie between 500M and 1B transactions. The volumes of Weekly transactions are between 3B and 5B while the volumes of monthly transactions are between 15B and 20B.

4.5.3 Technology Systems at leading stock Exchanges worldwide

<table>
<thead>
<tr>
<th></th>
<th>Technology systems improved regularly</th>
<th>Technology systems improved due to emerging need</th>
<th>Efficiency is improved with technology systems improvements</th>
<th>Stakeholders are involved in technology systems improvements</th>
<th>Transactions happen real time</th>
<th>Traders access their funds real time</th>
<th>There are little or no challenges experienced while transacting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>1.5714</td>
<td>1.2857</td>
<td>1.2857</td>
<td>1.5714</td>
<td>1.1429</td>
<td>1.4286</td>
<td>1.8571</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Table 4.14 Technology Systems Statistics

The respondents strongly agree that Technology systems are improved regularly and that technology systems are improved due to emerging needs. Efficiency is improved with technology systems improvements, with transactions happening real time. Traders access their funds real time at other International stock exchanges. They agree that stakeholders are involved in the technology systems improvements and that there are little or no challenges experienced while trading at these exchanges.
4.5.3.1 Technology systems improvement

Figure 4.6 Technology Systems Improvements

Figure 4.6 above shows that, in the technologically advanced stock markets, the technology systems are improved regularly, with 58% strongly in agreement.

4.5.3.2 Technology Systems are improved according to emerging need

Figure 4.7 Emerging Need for Technology Systems Improvement

The respondents according to figure 4.7 above strongly agree that technology systems at leading stock exchanges are improved due to emerging need.
4.5.3.3 Efficiency is improved with technology systems improvements

<table>
<thead>
<tr>
<th></th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>71.4</td>
</tr>
<tr>
<td>Agree</td>
<td>28.6</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4. 15 Efficiency with technology systems improvement

From the findings of the research 71.4% of the respondents strongly agree that efficiency in trading is improved with technology systems improvements at leading stock exchanges, while the rest 28.9% agreed with the statement.

4.5.3.4 Stakeholder participation

Figure 4. 8 Stakeholder involvement

The stakeholders are seen to be actively involved in technology systems improvements with all of the respondents agreeing and strongly agreeing to this.
4.5.3.5 Transactions Happen Real Time

Figure 4. 9 Real Time Transactions

In leading stock exchanges, transactions are processed almost immediately after a trading request is made. From the findings of the research 86% of the respondents agree strongly while the rest agree with the statement.

4.5.3.6 Traders Access their funds real time

Figure 4. 10 Access to funds

The respondents strongly agree that access to their funds after trading at leading stock exchanges is instant while the remaining agree.
4.5.3.7 Little or no Challenges experienced while transacting

While trading at the leading stock exchanges, the respondents agree that minimal challenges are experienced.

4.6 Chapter Summary

From the findings, the technology systems in place at the NSE are at the moment sufficient but may need to be progressively improved if they are to provide increased capacity for increased transaction volumes. Regulatory requirements are seen to limit technology systems advancements at the NSE. Technology at leading stock exchanges is seen to be advanced, constantly improved with trading volumes that are about 4 times what is carried out at the NSE. Chapter 5 provides the Discussion, Conclusion and the Recommendations.
CHAPTER FIVE
5.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction
This chapter discusses the results and findings of the study on relevance of progressive technology at the Nairobi Securities Exchange. The chapter also gives conclusions based on objectives set before the study was conducted and gives recommendations given the limitations of the study.

5.2 Summary
The study aimed to evaluate the relevance of progressive technology at the Nairobi Securities Exchange. To realize this, the study looked at the various factors that affect technology systems improvements at the NSE. Explanatory research design was employed to gather information on the factors that influenced technology systems advancements at the NSE. Simple random sampling was used to allocate and study a sample of 40 respondents, picked from investors, NSE managers and Stock brokers. Questionnaires were used to gather data, which was then collected, edited and cleaned. This data was then analysed on SPSS 21 as well as Microsoft Excel 2016 for the creation of information to be analysed. The information was later presented using descriptive statistics that included frequencies, percentages, mean, standard deviation and mode.

The first objective of this study was to assess the technology systems currently in place at the NSE. The study found that the technology systems at the NSE to be efficient. The study also found out that the technology systems in place are in line with Internationally accepted standards as per the belief of the interviewees. The users of these systems were also seen to have good understanding with their usage. Minimal challenges are experienced while using these systems and transactions were effected almost immediately. It was also seen that the volumes of daily transactions at the NSE were over 300 million, weekly transactions of over 1 billion and monthly transactions of over 5 billion. The respondents also rated the transactions carried out to be highly accurate.

The second objective of this study was to determine the factors affecting technological advancements at the NSE. The study found that there was a recent technology system upgrade that had been conducted and that these changes are made regularly. The team of
employees at the NSE were also seen to be conversant with technology systems in place. Stakeholders were involved in technology systems improvements. The study also found that a couple of challenges were experienced once technology system changes were made. The study also found that the respondents only traded at the NSE and were not involved in trading at other security exchanges. Trading in stocks was seen to be popular, while the trade in bonds was seen to be less popular with the respondents. The study also found the stock brokers to be highly reliable. The study also found that transactions were processed within 0-1 minutes of trading with the stock prices being readily available to the traders. The study however found the pay up of cash after trading to be slow, taking a period of 3 days. Trading online was however found to be convenient and straight forward. The study found that systems at the NSE needed improvement; this is mainly because of the pay up period of three days that is long and could be detrimental to the investor or the investee whose investment fluctuate adversely within the three day payback period.

The final objective was evaluating the technology systems in place at leading securities exchanges worldwide. The study found the New York Stock Exchange to be the leading stock exchange worldwide with average daily trading volumes of between 500million and 1 billion, weekly average trading volumes of between 3 billion and 5 billion and monthly average trading volumes of between 15 billion and 20 billion. The study also found that technology systems at leading stock exchanges were improved regularly due to emerging needs. Efficiency was seen to improve with technology advancements, with stakeholders being involved in these changes. The study found transactions at these leading stock exchanges to be real time, with even access to funds being real time. Minimal challenges were experienced while trading and interacting with these technology systems.

5.3 Discussion
In this section, the results and findings are discussed in relation to the research questions. This was then used to evaluate the relevance of progressive technology at the NSE.

5.3.1 Technology Systems at the NSE
In the NSE, technology systems were seen to be efficient. Sixty percent of the respondents strongly agree that the technology systems are efficient, when compared to 40% who only agree to this, on the efficiency. This efficiency is seen to have improved after automation of
the technology systems at the NSE, (Okumu, 2013). The technology systems are seen to be at par with international standards according to 70% of the respondents who strongly agree to this as compared to the 10% who are neutral on the matter. This is confirmed by a study by Okumu, (2013), that the NSE launched a central depository system (CDS), on 24th November 2004, having been procured from Millennium Information Technologies (MIT) of Colombo, Sri Lanka at a cost of Ksh.100 million, which is the technology system in use by the London Stock Exchange.

The technology systems familiarity with the users is fair with 40% of the respondents agreeing with this, while 30% strongly agree to this, 20% being neutral on the matter while the other 10% disagree to this. This shows that the users have been properly trained in regards to using the system. This increases system usage as familiarity makes it more popular to the users. There have also been less challenges with the systems usage with 50% agreeing that there are minimal challenges with the technology systems usage, 20% of the respondents strongly agree to this, 20% are neutral and 10% disagree with this. This shows that the users experience minimal challenges when dealing with NSE system.

Transactions at the NSE are seen to be processed real time with 50% agree, 40% strongly agree and 10% neutral opinion on the same. Average speeds of between 0-1 minutes on trading, was given by 90% of the respondents. This is a very high level efficiency on transactions processing and little can be done to improve it (instant processing at the touch of a button). The transactions were also observed to be highly accurate with 100% strong agreement on accuracy.

The study also displayed the volumes of transactions traded at the NSE to be lower when compared to the International markets. A response of slightly over 300 million daily transactions was given by 78% of the respondents, which is lower compared to 500 million to 1 Billion transactions in International markets. According to a CMA’s quarterly report (2016), transactions of 10 to 50 million are recorded to be traded daily. This amounts to about 10 times less of those traded in other leading stock exchanges.
5.3.2 Technology Advancements at the NSE

Technology systems advancements are recorded to have been made this year, according to 60% of the respondents and 40% disagree on the same. The study shows that 60% of the respondents are of the idea of having regular technology system advancements. Though the development is seen to have been effected this year, it does not reflect regular changes. The need for regular updates is crucial to improve on trading and increase efficiency, transparency and liquidity. Wathiru, (2015) suggests that price efficiency is a public good that can inform corporate investment and financing decisions. A faster market can also enhance welfare by reducing risk-averse traders’ uncertainty about the probability and price at which execution may occur. Furthermore, faster trading can facilitate more complex trading strategies.

Assessment of systems before any changes are made is fairly effective with 60% agree response. The need to analyse the gap and find the solutions to fill the gap is critical in any development. With assessments that are not keen, then the technology system changes only led to further gaps.

The stakeholders are not entirely involved in the systems changes. Thirty percent strongly agree that the stakeholders are not involved in system changes while 60% agree to this. The stakeholders include the investment brokers and the staff at the NSE, who are the people who mostly interact with the system and understand its weak points. Having them involved could go into improving the progressive technology systems in place to fit the needs of all involved.

Regulatory requirements somewhat influence and affect the progressive technology systems advancements with 12.5% strongly agreeing to this while 37.5% agree. The regulators in the securities exchange involve the CMA and CDSC. The directive of council of ministers (2014) regulates on major operational interruptions that may impact business functions and operations. Hence, changes cannot just be made that was impact operations at the NSE, making it difficult to impose changes every so often. System challenges are experienced once changes are made, that impact operations and cause strife among the investors if not addressed instantly.
The study observed that 57.1% of the respondents strongly agree that they frequently traded at the NSE. Among this population, 14.3% were neutral about trading in other stock exchanges, with 50% trading in shares and 14.3% trading in bonds. A reliable stock broker ensured all this trading is easily transacted. Fifty-six percent agree that their stock brokers are reliable and therefore showing with the right technology systems in place, efficiency would be increased.

This study further shows that transactions at the NSE are processed instantly an indication that the technology systems in place may be efficient. The stock prices are seen to be readily available, provided through platforms from stock brokers and from the NSE. Funds are easily accessible after trading with the t+3 days allowed by CMA for cash and instant access if reinvesting back the funds.

Straight forward trading is made possible with the use of the online trading platform provided through stock broker platforms. Fifty percent of the respondents strongly agree to this. While using the brokers to trade, there might be a bit of delay due to the authorization and approval processes. The respondents agree that the technology systems need to be improved so as to cut down on the payment period of three days as well as by cutting down on the approval method as well as period. This shows that there is need for progressive technology at the NSE.

5.3.3 Technology Systems at leading stock exchanges

This study shows the New York Stock Exchange as the leading stock exchange, 88% and the NASDAQ to be the second leading stock exchange worldwide 12%. Transactions volumes traded in these exchanges have been viewed to be between 500 million and 1 billion transactions, as given by 30% of the respondents, which are fairly high as compared to the NSE at 10 to 50, million transactions.

The findings of the study show that, 57% of the respondents strongly agree that the technology systems at the leading stock exchanges worldwide are improved at intervals that are more regular than the NSE. It continues to show that these systems are improved with emerging need, which is why they are efficient.
The stakeholders involved in these markets are highly involved in technology systems improvements. This helps ensure that the changes put in place impact them positively and are in line with emerging needs. Eighty-six percent of the respondents agree that the transactions in these exchanges are real time (at the press of a button). This helps ensure consistency and continuous trading. The traders are able to access their funds real time according to 50% of the respondents who agree with this. This ensures continuity with ready cash flow to transact other trades. Little or no challenges are experienced while trading in these stock exchanges, with 57% agreeing with this. This shows that though the NSE may be operating at high levels there is still room for improvement.

The technology systems in leading stock exchanges are improved regularly according to 58% of the respondents. This ensures that bugs that exist in the systems are fixed to provide efficient and reliable systems. Emerging need is what causes the systems to be regularly improved with 72% of the respondents strongly agreeing to this. There is progressive advancement in the ways in which people access resources and money and hence the need to progressively advance the systems. Efficiency is achieved once the systems are improved with 72% strong agreement to this. The traders are able to conveniently transact and therefore making it efficient to their current needs.

The stakeholders in leading stock exchanges are actively involved in the systems improvements and implementation so that they fit in the traders shoes. This way, the traders concerns become their concerns bringing improved services to all. Transactions happen real time so that there is no bias when it comes to trading. Fairness is practised as traders are served on a first come first served basis. 86% of the respondents agree to this when it comes to trading in leading stock exchanges.

After trading at leading stock exchanges, the traders access their funds real time. Once a sale is affected, your funds immediately reflect in your preferred choice of payment. Very little to no challenges are experienced while trading according to 58% of the respondents. This makes it easier to access the shares, bonds or any other trade that you would wish to participate in without having to manually visit your stock broker or interacting with them. You can transact at the comfort of your home, on the bus or even at a restaurant.
5.4 Conclusions

5.4.1 Technology Systems at the NSE

The NSE is seen to have technology systems that are efficient and close to those at international levels. A similar system exists at the London Stock Exchange, which is among the leading stock exchanges in the world. The challenges experienced while using these technology systems are viewed as minimal and the users are fairly familiar with its usage. With stakeholder inclusion in the progressive technology development, the systems could become increased in their familiarity in terms of usage as well as increase the users’ efficiency of the trading systems. Transactions are processed almost instantly with the average speed of trading being between 0-1 minutes and very accurate trade prices. The average volume of trading transacted at the NSE from the study are between 10 and 50 million, weekly volumes of between 50 to 250 million and monthly volumes of between 250 million to 1 billion. This can be increased with investor awareness and training.

5.4.2 Technology Advancements at the NSE

This study concludes that technology system advancement has been made this year at the NSE. The changes are regular according to 60% of the population sampled, though not consistent. Assessment is carried out before any system changes are made, with the stakeholders being highly involved in these technology system changes. Stakeholders tend to be key in any organization as they keep it running. The regulatory bodies in Kenya that include the CMA and CDSC control the changes that can be made at any particular time. This is due to investor trading that may be interfered with once a technology system change is made, therefore interfering with the market. It is noted that though there are system changes employed, they do not become most efficient as they do not incorporate the views of the stakeholder.

A majority of the respondents in this study also trade frequently, which would make it difficult to make changes without regard of this frequent traders. Very few investors were seen to trade in other stock exchanges and a disruption to their trading would have them not trade at all which is inconveniencing especially to those whose livelihoods depends on the stock market. Trading in shares is seen to be popular as compared to trading in bonds, with 50% of the respondents saying they were involved in the equities trading and only 14.3% of
the respondents traded in bonds. The stock brokers are reliable, which implies that they have provided their clients with the required platforms to conduct their trading. The speed of processing orders from traders is fast with the trading prices being readily available for the traders at the time of the transactions. This system applies to traders who trade via the online platform while for other traders who use their stock brokers to conduct trading, this process might take a while longer. The availability of funds after trading is provided after a period of 3 days and instantly in some brokerage firms. With instant access to funds, this ensured liquidity for the traders where they would re-invest instantly in other markets. The technology systems at the NSE have room for improvement so as to incorporate the weaknesses listed above and keep up with progressive technology from around the globe so as to provide efficiency and reliability in trade.

5.4.3 Technology Systems at leading stock exchanges

This study concluded the NYSE as the leading stock exchange worldwide, followed by the NASDAQ. These stock exchanges are reported to have massive transactions of up to 1 billion in a day. The NSE has internationally recognized system and can therefore handle such volumes of transactions as well. In the leading stock exchanges, this study shows that the technology systems are improved regularly, with emerging need as well as inclusion of the stakeholders. This shows the embracing of progressive technology in order to provide the traders with efficient and reliable trading. The stakeholders are fully involved when this technology systems upgrades are made. Real time transactions are the norm with instant access to funds, with little or no challenges while trading.

5.5 Recommendations

5.5.1 Recommendations for Improvement

5.5.1.1 Technology Systems at the NSE

The technology system users, that include the traders, brokers and staff, need to be sensitized on the importance of training in order to understand usage of the systems well. This could have increased transaction volumes with minimal challenges experienced while trading using these systems.
5.5.1.2 Technology Advancements at the NSE

Regular assessments of the technology systems need to be carried out to ensure all the user needs are met. This will ensure efficiency and reliability is realized in trading and ease access. The stakeholders should also be fully involved in the changes to these technology systems so that the arising needs are captured in the changes. The regulators need to ensure that proper testing is carried out before implementation is done, so that minimal to no challenges are experienced after the changes. The delay in payment after trading should be reduced to nil to provide for liquidity for the traders. This will ease entry and exit into the markets thereby increasing the volume of trading.

5.5.1.3 Technology Systems at leading stock exchanges

To ensure that the trading volumes of leading stock exchanges are realized at the NSE, the public needs to be sensitized on the benefits and importance of trading at the securities exchange. Proper training should follow so that traders are not lost along the way and to ensure continuous trading patterns.

5.5.2 Recommendations for further research

The study involved gathering data locally on the international trading patterns. Further studies can collect more data from international investors, brokers and regulatory bodies on the trading behaviours. The study realized that according to the investment brokers and managers, the NSE is operating efficiently. Further research could have conducted to find out how other stakeholders like the investee feel about the efficiency of the NSE as well as areas of improvement. Further research could look at ways of aiding the NSE to be at par with NYSE or the NASDAQ or even be the best securities exchange firm in place. Future research could additionally be conducted with the rural population in various parts of the country.
REFERENCES


