EFFECT OF TECHNOLOGICAL INNOVATIONS ON THE VALUE OF MANUFACTURING FIRMS LISTED AT THE NAIROBI SECURITIES EXCHANGE

JULIE AKINYI OMOLLO

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DECLARATION

I, the undersigned, declare that this is my original work and has not been presented to any institution or university other than the University of Nairobi for examination.

Signed:  Date: December 1, 2020

JULIE AKINYI OMOLLO

D61/11725/2018

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

Signed:  Date: December 1, 2020

DR. WINNIE NYAMUTE

Department of Finance and Accounting

School of Business, University of Nairobi

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I take this opportunity to thank the almighty God for seeing me through the completion of this project. I would also like to thank my supervisor Dr. Winnie Nyamute for the guidance throughout the project process.

DEDICATION

I dedicate this work to family. I thank you very much for the patience and sacrifices that you have made for me.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CMA	Capital Markets Authority
MSE	Micro and Small Enterprise
MSE	Micro and Small Enterprises
NSE	Nairobi Security Exchange
R&D	Research and Development
ROA	Return on Assets
ROE	Return on Equity
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
VIF	Variance Inflation Factors

ABSTRACT

A major assumption that many studies on improvement of operations is that innovations adoption is directly related to improvements in firm value. The success of many firms is mainly dependent on efficient operational processes resulting from additional investment in technological innovations which enhance the internal efficiencies of a firm. Thus innovation strategies adopted by firms should assist in the identification and exploration of new revenue avenues and improve firm value. The objective was assessing effect of technological innovations on value of NSE listed manufacturing firms. The population for the research was all the 9 NSE listed manufacturing firms. Predictor variable in this research was technological innovations operationalized as the ratio of R&D expenditure to total sales revenue. The control variables included liquidity given by current ratio, leverage given by total debt to total assets and management efficiency given by total revenue to total assets per year. Firm value was the response variable given by market value to book value of equity. Secondary data was for five years (January 2015 - December 2019) annually. Descriptive cross-sectional design was used in analysis of the study variables. Analysis was made using SPSS software. Findings produced R-square value of 0.259, meaning that 25.9 percent of changes in value among manufacturing firms is the result of variations in the chosen independent variables while 74.1 percent variation in value of NSE listed manufacturing firms was the result of other factors which are not highlighted. This research showed independent variables had a moderate association with firm's values (R=0.509). ANOVA results showed that the F statistic was substantial at 5% level with p=0.000. This implies that the overall regression model appropriate in explaining how the independent variables impact firm value. Findings also showed that technological innovations, liquidity and management efficiency positively and significantly influence value of the NSE listed manufacturing firms. Financial leverage was statistically insignificant in this study. This recommendation is that NSE listed manufacturing firms should focus on enhancing their technological innovations, liquidity positions and management efficiency as these three have a significant influence on their firm value.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The success of many firms is pegged on efficiency in operations resulting from additional investments in technological innovations that enhance the internal efficiencies of firms (Munyoroku, 2014). Therefore, technological innovation strategies that firms have adopted should assist them in identifying and exploring new revenue opportunities and improving customer satisfaction by having efficient delivery systems that would contribute to firm value. Technological innovation strategies involve adopting systems providing capabilities which support and enhance production processes (Pisano & Teece, 2011). McAdam and Keogh (2014) opined in their research that organizations that embrace technological innovations have a competitive edge over their competitors. Other scholars however, suggested that product acceptance and proper timing is the best measure of how innovation contributes to value of firms.

This study's theoretical foundation was built on technology acceptance model, the diffusion of innovation theory and disruptive innovation theory. The diffusion of innovation theory states that adoption of technological innovations by individuals is based on the individual`s perception with respect to comparative advantage occasioned by use of technology (Rogers, 1995). This then forms the basis for which firms` view innovativeness, complexity, compatibility and relative advantage of adopting technology. Technology Acceptance Model (TAM) on the other hand centres on the how external factors influence the adoption of technology such as user`s behavioural expectations (Davis, 1989). Disruptive innovation theory centres on how technology completely changes the way in which a firm conducts its business whereby

the methods of operations typically adopted by the firm are completely reviewed with the adoption of new technology (Schumpeter, 1934). These theories have generated interest in conducting research on how technological innovations impact the value of manufacturing firms.

Some listed manufacturing and allied companies such as Mumias Sugar have experienced financial crisis which have been attributed to lack of technological innovations. Despite the government involvement to support, the company is not able to settle down farmer's debts hence loss of raw materials and significant drop in sugar production (CMA, 2018). Other manufacturing firms with a listing at the NSE such as Eveready East Africa Ltd and Unga group have also had issues and therefore the need to investigate whether technological innovations have a significant influence on the value of manufacturing and allied firms with a listing at the NSE.

1.1.1 Technological Innovations

Technological innovations are the activities that harness development and design of new products, services and techniques involved in improving and redesigning existing products (Picano & Teece, 2011). According to Schumpeter (1934), technological innovation refers to the changes in the product, process, and organization that are not necessarily from new discoveries in sciences. Innovation is achieved by combining already existing technologies and applying them in a new context. From this definition, technological innovation encompasses: service innovation, product innovation, business model innovation and process innovation and all leading to strengthening the company's competitive advantage (Yahya & Marwan, 2011).

Al-Jabri (2012) indicates that most innovations involve technological advancement. In this respect, development of technology is an important impetus to innovations. The

need to establish a competitive edge has been attributed to be a major factor that makes firms engage in Research and Development (R&D). According to Atman (2013) a firm that needs to achieve the generic goals of survival, growth and ultimate enhance value ought to have innovation being one of its strategic goals. This is because it is only through offering innovative products that firms can be market leaders in their niche.

Different researchers have operationalized technological innovations differently. Saemundson and Candi (2014) operationalized technological innovations in three ways namely product, process and market. Product innovation involves the creation of products or services or the development of existing ones. Process innovation involves the adoption of new techniques that will assist the organization in remaining competitive and to constantly meet demands. Market innovation is an improvement of the mix of targeted markets and the manner in which they are served to increase access to goods and services using newer distribution channels in the domestic and international markets. Arora, Belenzon and Rios (2014) used annual R&D actual expense as a proportion of annual sales as a measure of technological innovation and this measure will be adopted in the current study.

1.1.2 Firm Value

According to Modigliani and Miller (1961), firm value is a financial measure that indicates its value in the market. It is the sum of all claims made by investors, that is, the secured and unsecured creditors, the preference and common equity holders. Value of the firm can also be defined as the discounted cash flows from assets and future growth, discounted using the cost of capital (Damadoran, 2002). The strategic purpose of any firm is to ensure maximization of the firm's value or shareholder’s

wealth (Berle & Means, 1932). Dalborg (1999) explained that the value of a firm is generated from the shareholder's earnings, in share price as well as dividend grows and becomes more than the return risk-adjusted rate necessary for the stock market. Copeland (2000) indicated that in the market value is created through earning a yield to the investment (return) more compared to the opportunity of capital cost.

Value of firm explains past, present together with the firm's future performance together with the long-term expectations of the investors who are the stakeholders as well as the shareholders. All the investors, financial institutions appraise the value of firm before investing their money in the firm business. There will be no creation of value for investors when the firm is not capable to make profit for investors. earlier stock price was used in explaining the firm value but in the present world of finance, the focus by researchers and financial experts has been shifted towards studying the firm (enterprise) value to explain firm value (Oladele, 2013).

The value of the firm can be measured using several means for example total assets, net sales, capital employed, paid-up-capital and so on (Sharma, 2011). The expectation is that the firm's value is a reflection of both the tangible and intangible assets. A common tool that gives the measurement of firm value is Tobin's Q. This is a proportion of a firm's market value to the cost of replacement of its assets. It gives a measure of the value of the firm based on book value rather than market based models. The measure proposes that affirm can create more value if the returns made by the investment are greater than its cost (Taslim, 2013). The current study will apply Tobin Q to measure firm value.

1.1.3 Technological Innovations and Firm Value

A key assumption made by many studies on improving operations is that innovations adoption has a direct relation to firm value (Upton & Kim, 2016). The process of adopting an innovation adoption and implementing it is a crucial aspect in the growth of many nations. Changes in conventional methods and adoption of modern technology that is likened to those of industrialized nations increases domestic innovations (Roehm & Sternthal, 2001). Advancements in innovations has increased task efficiency minimized costs but has also come with many challenges (Aladwani, 2001).

The success of many firms is mainly dependent on efficient operational processes resulting from additional investment in technological innovations which enhance the internal efficiencies of a firm (Munyoroku, 2014). Therefore innovation strategies implemented should assist firms in the identification and exploration of new revenue avenues and improve customer satisfaction by having reliable delivery systems. Innovation strategies involve adopting systems that provide capabilities supporting and enhancing the processes related to production (Valacich & Schneider, 2012).

Prodromos and Dimitrios (2018) establish that technological innovations help business organizations enhance their value, when it greatly relies on the organization's unique capabilities and technologies. Nuryakin (2018) stated that there are positive results between technological innovation and the firm value. Technological innovation is required by firms to be able to produce quality products, use efficient processes and systems to have a competitive edge.

1.1.4 Manufacturing Firms Listed at the Nairobi Securities Exchange

The NSE which was formed in 1954 is responsible for the listing of firms and issuing of securities bought and sold by individual and institutions both local and foreign through the services of stockbrokers or dealers. The mandate of NSE is to oversee its members and provide a trading platform for the listed securities. The NSE provides the main hub for trading in the secondary market. It provides a trading floor which though available is not commonly in use after being replaced by the automated trading system. Through a wide area network, members trade at the comfort of their offices. The system is efficient, transparent and can handle large volumes of transactions at the same time. There are currently 9 manufacturing and allied companies quoted at the NSE (NSE, 2019).

Some manufacturing and allied listed companies have faced a series of issues in the recent past. A good example is Mumias Sugar that have experienced financial crisis despite the government involvement to support the company. Njagi (2016) attributes this to having little or no technological innovation at all. The company is not able to settle down farmer's debts hence loss of raw materials and significant drop in sugar production. Other manufacturing firms listed at the NSE such as Eveready East Africa Ltd and Unga group have also had innovation issues and therefore the need to investigate whether technological innovations has a significant influence on the value of NSE listed manufacturing and allied firms.

To increase their value, manufacturing firms listed at the NSE should develop technological innovations so as decrease costs and increase profits in their operations. Innovation decisions are crucial in the overall strategy of the firm so as to maximize shareholder wealth in firms (Siddiquee, Khan, Shaem & Mahmud, 2009). Over the

past years, several listed firms have had financial problems that have led to their suspension from trading, shutting down some of the operations or being put under receivership. Their inability to meet payments to suppliers of goods and bank commitments has been proposed as one of the reasons. Such firms include Unga Group Ltd and Mumias Sugar Co. Ltd.

1.2 Research Problem

The knowledge innovation capacity of entities relying on technology is crucial elements of internationalization and performance (Sher &Yang, 2005). Of late, the knowledge based view has come out as a modern, new perspective in examining the impact that innovation has on performance Davenport, et al. (2003) state that a firm strategy that is pegged on technology can enable firms to leverage their strengths in an effort to gain international significance. Additional views on the role that technology plays in determining the future of a company include its significance in creating barriers to entry and exit for competition (Porter, 1983), as a useful tool in raising the firm's market value (Toivanen et al., 2002), as a crucial rent-producing asset (Teece et al., 1997) and an instrument for institutional change (Birkinshaw et al., 2002).

Different manufacturing firms listed at the NSE have been performing differently. While firms like East Africa Breweries Ltd and British American Ltd have posted good results and able to increase value to shareholders, others like Mumias sugar, Unga group and Eveready East Africa Ltd have performed dismally and their firm values have gone down (Aboka, 2018). While the reason for some firm's reduction in firm value may be due to the nature of the environment they are working in and that is not under the control of the management or board, studies have shown a significant link between technological innovations and firm success and therefore the need to

investigate whether indeed technological innovations have a substantial influence on value of manufacturing firms with a listing at the NSE.

Different empirical literature has been directed on the influence of technological innovations on value of firms but the findings have been inconsistent. Irina and Elvira (2015) sought to evaluate how innovation influences company value. The findings from the study indicated that innovative companies have greater value and are significantly bigger. Zhang, Khan, Lee and Salik (2018) by utilizing correlation and multiple regression analyses discovered that innovation is a substantial determinant of company value. Size was found to be weak and less significant as a factor. Worch and Truffer (2012) revealed that operations innovations maximize the value of a firm and increases its productivity. These studies were conducted in different countries, within different economic conditions and used different models.

Although there are several studies conducted locally in this area, there exist conceptual, contextual and methodological gaps. Conceptually, most of the studies have operationalized technological innovations differently and therefore the findings are based on the proxies used. Further, the focus of many studies is on the influence of innovations on firm performance which does not always translate to firm value. Contextually, the studies have not focused on NSE listed manufacturing firms, Kiggima (2018) focused on micro and small enterprises, Mutie (2018) focused on government agencies while Waweru (2018) focused on agricultural firms. Methodologically, studies have used different methodologies; Ekuam (2019) conducted a qualitative study where primary data was obtained with the aid of interview guides while Kiraka, Kobia and Katwalo (2013) conducted a quantitative study relying exclusively on a structured questionnaire. The current study was

quantitative in nature relying on secondary data. These research gaps were the motivation for answering: What is the effect of technological innovations on the value of manufacturing firms listed at the NSE?

1.3 Research Objective

The objective will be to assess the influence of technological innovations on the value of NSE listed manufacturing firms.

1.4 Value of the Study

The findings will further explain innovation theories and practices. It will also be an addition to the already documented information regarding the association between innovation and value of firms and also fill the gap on how these variables relate for future reference by other researchers.

The study is beneficial to the manufacturing firms in understanding the linkage between the two variables which is crucial in having a strong team of innovators with varied perspectives and capabilities necessary for financial success and in creating trust among company stakeholders.

To government and key policy makers, it will be beneficial in aiding the formulation of policies and procedures that would steer manufacturing firms in adopting innovative practices that would improve their efficiency which in turn will improve sector performance.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The purpose of this section is to present a review of the theories onto which this study is based. Prior empirical work on this subject and other related areas will be reviewed in this chapter. Additionally, the determinants of firm value will be reviewed and a framework illustrating the relationship the variables have will be contained in the study.

2.2 Theoretical Framework

In this section theories explaining the study phenomena are reviewed. The theoretical reviews covered are the disruptive innovation theory, diffusion of innovation theory and the technology acceptance model.

2.2.1 Disruptive Innovation Theory

The theory by Schumpeter (1934) states that, entrepreneurs can use innovation for greater profits. The large amount of profits will set in imitators who shall ultimately reduce the level of supernormal profits in the industry. According to Schumpeter (1934), entrepreneurs play an important role in coming up with completely new ideas that are novel, untried and untested. This theory states that, innovation is important in development of the country in terms of its per capita income (Abramovitz, 1956; Solow, 1957).

King and Baatartogtokh (2015) found four crucial factors in the theory of disruption: The first is that incumbent firms improve along a trajectory of innovation. As innovating companies introduce new and improved products, they provide a trajectory of improvement to incumbent businesses through adoption of sustaining innovations,

which improve services or products in areas that value has been established; The second element is that as incumbents adopt sustaining innovation by positioning their products on mainstream customers' current needs, they eventually end up overshooting customer's future needs; The third element is that incumbents fail to exploit their capability to respond to potential disruptors, who lure them into complacency by not targeting their main customers and instead targeting new and low-end customers with products that are cheaper and more convenient even though of lower quality than those currently available; The forth element sees the incumbents eventually floundering as a result of the disruptive effects that result thereafter.

Through technological innovation, new products emerge in the market that imitators copy because of the supernormal profits being generated by the product. This theory is relevant because manufacturing firms need to be innovative in developing newer products that will maintain their competitive edge at this time of business environment turbulence and intensified competition. Innovation can help manufacturing companies to effectively differentiate their products with unique features for customer satisfaction and therefore maximize firm value. This is therefore the main theory guiding this study in exploring a link in technological innovation and the ability of manufacturing companies to gain firm value.

2.2.2 Diffusion of Innovation Theory

This theory was pioneered by Rogers (1995). Mahajan & Peterson (1985) stated that, an innovation is an idea, practice or object launched in a social system at first attempt whereas innovation diffusion is the relaying of the innovation using select mediums overtime within the same system. The theory therefore describes the medium through which new inventions are utilized within a community (Clarke, 1995).

Sevcik (2004) stated that, adopting an innovation is not instantaneous rather it takes time. Additionally he argues that various issues influence this process including the resistance to change which slows down the process. The process is the result of five characteristics; its advantage, how compatible it is, how complex it is, observability and triability (Rogers, 1995). He argues that adoption of innovation is dependent on the perception of an entity towards its relative advantage, triability, compatibility, complexity and observability. When an entity in Kenya benefits from internet banking, then it will adopt the innovation provided other prerequisite tools are availed. The adoption of innovation is much more quicker in entities with information technology departments and access to internet access compared to those that lack these facilities. The theory is relevant because it explains the adoption of innovation among entities.

2.2.3 Technology Acceptance Model

This model was founded by Davis (1989). It relates to the manner in which consumers adopt an innovation, which is usually determined before selecting a system which will be relevant and offer convenience to the customers. Authors in this field studied the fundamental ideas behind the validity of TAM in predicting how technology acceptance by an individual will take place and made the conclusion that the fundamental idea behind TAMs fails to explain how the acceptance by users is influenced by technology and several other usability factors (Moon & Kim, 2015). Davis (1989) contends that the perceived usefulness refers to the belief by an individual that the technology adopted will significantly improve job performance after its adoption. Perceived effortlessness of use indicates how easy it is for the individual to learn how to utilize the new technology and information system. The

model emphasizes on the simplicity of use as the manner in which the usefulness of a system is predicted (Gefen, Karahanna & Straub, 2013).

Pikkarainen, Pikkarainen, Karjaluoto and Pahnila (2014) conducted a study in Finland with the aim of establishing the real effect of predicted benefit and made the conclusion that it required the use of innovative, independent, self-service and technologies that are friendly to the user through the banking system to provide financial services to clients in the twenty first century. Evidence points at how importance the perceived usefulness of a technology in efforts to adopt it. Tan and Teo (2013) state that this usefulness of any technology has an impact on its adaptation. In conclusion, the greater the predicted usefulness of using technological innovations, the higher the chances of it being adopted (Potaloglu & Ekin, 2015). The key drivers of innovations acceptance are considered to be TAM variables that include elements of anticipated ease of use and anticipated usefulness.

2.3 Determinants of Firm Value

Many factors determine company value. Such factors are usually similar across many sectors of the economy. They include market sentiments, company news and performance, the liquidity position of a company, management efficiency, financial leverage, firm age and macro-economic variables.

2.3.1 Technological Innovations

A key assumption that many studies make on improving operations is that the adoption of innovation directly encrourages improvements in firm value (Upton & Kim, 2016). The process of adopting and implementing innovation is a crucial factor in the growth of economies. Changes in conventional techniques and in favor of local technology that is similar those used by developed nations encourages indigenous

innovations (Roehm & Sternthal, 2001). Adoption of innovations has eased the accomplishment of tasks more efficiently and less costly but comes with a number of challenges (Aladwani, 2001).

Kantor (2001) is of the opinion that technological innovation is a crucial factor that determines the progress of an economy in country as well as in establishing a competitive edge in different industries. A crucial role for both large firms, medium, small and micro is played by technological innovation (WladawskyBerger, 2008). Kemp (2003) maintains that innovation has been one of the best competitive weapons in an organization and is renowned as a business's core.

2.3.2 Firm Liquidity

This is the degree that a company has capacity to settle its outstanding debts in a period of 12 months using cash and its equivalents like assets with a short term nature which can be rapidly converted to cash. This factor stems from the management's ability to honor their obligations falling due to financiers and to other creditors without increasing earnings from activities including underwriting and from their investments and their capability to sell off financial assets (Adam & Buckle, 2003).

Liargovas & Skandalis (2008) state that firms can utilize liquid assets to fund their operations and investments in the event that external financing is unavailable. Firms that have high liquidity are able to cope with unpredicted contingencies and meet obligations falling due in situations where earnings are low. Almajali et al., (2012) on in a study of insurance companies found that liquidity is a crucial factor affecting their performance; the main recommendation from this study was that firms should acquire more current assets and lower their liabilities. Jovanic (1982) noted that excess

liquidity may cause much more harm to companies. His conclusion was that the effect of liquidity was ambiguous in financial performance.

2.3.3 Firm Leverage

Leverage refers to a firm's ratio of debt to equity capital. The ratio of the two impacts cost of capital and firm value (Pandey, 2010). The amout of debt held by a firm impacts it's financial performance. Jensen (1986) stated that, debt financing lowers moral hazards by lowering the cash available to managers. This raises the pressure to perform thereby positively impacting a firm's performance. Firms with a higher leverage are in a position to register a positive financial performance. A number of researchers have studied the relation that firm performance and leverage have and found that a high leverage mitigates the existing conflict that the management and shareholders have thereby improving performance.

Baker (1973) studied the relation that industry gainfulness and influence and found evidence of the impact of hazard in the productivity of an industry. By using information for a ten-year time frame, he measured influence the proportion of value to aggregate resources. A low leverage level would mean that there is more utilization of debt capital as opposed to debt to value or debt to aggregate resources. He measured benefit using net income. The study concluded that the conditions in te industry impact the decision by the company to influence. Additionally, he concluded that organization that have a higher debt capital registered more productivity.

2.3.4 Management Efficiency

This is a crucial internal characteristic that is a qualitative measure and determines a firm's operational efficiency. The main of assessing this quality in an organization is

by efficiently utilizing firm resources, maximizing funding and properly allocating firm resources (Kusa & Ongore, 2013).

As a qualitative measure, managerial efficiency is a crucial determinant of operational efficiency and can be determined by the quality of staff, the effectiveness and internal controls efficiency, organizational discipline together with the effectiveness of the management systems (Athanasoglou et al.,2009). Management quality is influential to operating expenses level that impacts the bottom line of an entity hence this quality substantially impacts firm value (Kusa & Ongore, 2013).

2.3.5 Profitability

Profitability is defined as the net profit which is retained from the activities related to business and its decisions. Profitability is a expression of the effectiveness and efficacy of the operations conducted and also it reveals the impact of asset management liquidity and the company results liability. Suwanna (2012) defined profitability as a major factor for survival in the highly competitive market share. Investment in the capital items is among the critical ingredients which facilitate the profits gained by an organization (Lian et al., 2017).

Most investors will invest in the organizations that have good profitability to their investment only (Tapa & Hussin, 2016). Major hinters like the ROA, ROE and asset turnover have been in the past used as comparative to the organizations profitability in relation to the corporate governance levels, concentration of ownership or even can be used to predict future prices of shares and various other necessary applications (Maiyo, 2013). The rate of profitability is measured in regards to the performance measures such as, margins of sales and profit, asset returns, net worth returns among other variables (Suwanna, 2012).

2.4 Empirical Review

Research has been done locally, regionally and globally to support the association between technological innovations and firm value, with contradicting results.

2.4.1 Global Studies

Irina and Elvira (2015) attempted to examine the influence that technological innovation have on value of a firm. Utilizing data originating from the patenting functions of a company, they were able to construct a profile that consisted of the generation, dissemination and the degree of the innovations of a company. The main goal of the study was to predict the firm's market value using the dimensions of technological innovation using panel data analysis. 10 year cross sectional, longitudinal data from a firm's innovation profile was used together with lagged measurements of market value. The study found that innovative companies generally have a higher value and are significantly larger.

Onikoyi (2017) conducted a survey on how product innovation impacts operational performance of Nestle in Nigeria. In the investigation, 340 management personnel were interviewed in the marketing, research and development, sales, production and quality and control departments. These sections were selected due to their heavy involvement in the product innovation process. A regression and correlation analysis methodology was used and findings showed that product innovation improved the performance of the organization. It was pointed out by the customers that product innovation was different and beneficial.

Zhang et al. (2018) studied the effect of innovation on the value of a company. The focus of the study was on Baltic listed companies from the year 2005 to 2011. From the study findings, innovative companies were found to have a higher value and were

significantly larger. Within such companies, they observed that higher value was achieved when the proportion of intangible assets was greater than 1%. By utilizing correlation and multiple regression they found that innovation was crucial in determining company value. Size was found to be insignificant in determining value. The recommendations made by the researchers was that company should make investments in the process of innovation because it raises company value, more so if the proportion of intangible assets is greater than 1 %.

De Oliveira, Basso and Kimura (2018) analysed the relation between innovations and Brazil companies performance. By utilizing statistics from the Brazilian Institute of Geography and Statistics' official databases on innovation and performance, they did a study on 5,025 firms using exploratory factor analysis and structural equation modeling. From their findings, efforts in innovation had the potential to generate an impact; however, such impacts could not necessarily translate to better performance. Therefore, even though innovation efforts may create new products, in the short run, they may not necessarily result in financial gains which is a reflection of the riskiness and costly nature that innovation brings.

Mensah (2019) examined how financial innovations impact financial performance of several Ghanaian banks in terms of revenue generation, efficiency, liquidity, profitability and the general conduct of banking activities in Ghana. The study was in the form of a survey of bank executives from universal banks in Accra and Kumasi. They administered questionnaires to collect the opinions of bank executives on how financial innovations impact financial performance. According to the research, it was discovered that financial innovations improve significantly the efficiency, liquidity and profitability of the banks.

2.4.2 Local Studies

Mutie (2018) focused on how technological innovations impact performance of government agencies in Kenya. Technological innovations were operationalized as system development enhancement, digital tools and services, IT- based innovations and interdepartmental process integration. The study used descriptive cross-sectional survey design. Questionnaires were employed in the collection of primary data. Correlation and regression analysis were conducted. The study showed that performance of government agencies in Kenya is substantially affected by the variables selected.

Kiggima (2018) sought to examine how technological innovation impacts enterprise performance of Micro and Small Enterprises (MSEs) in Nairobi. The target population consisted of MSEs from different sectors. The study took 10% of the target population of 1539 hence obtaining a sample of 155 MSEs as respondents. Primary data was utilized. Data analysis was made using descriptive and inferential statistics. The study concluded that adoption of technological innovations gave the MSEs a competitive edge which boosted their performance.

Waweru (2018) aimed on exploring the impact of innovations had on the performance of agricultural firms with a listing at the NSE. A qualitative survey technique was used in the study. The study utilized primary data obtained using interview guides. The qualitative analysis was performed using content analysis. This was done in evaluating the responses, drawing conclusions and deriving recommendations. From the findings, it was concluded that appositive relation exists between technological capability and firm performance.

Ekuam (2019) studied how innovations impact organization performance of Internet Service Providers (ISP) in Kenya. This study used primary data acquired through interview guides. The targeted respondents in this study were managers of six largest ISPs in Kenya or their representatives. The primary data obtained was qualitative data and it was analyzed by content analysis. The study concluded that innovations, that is product and process, process, marketing and technological innovation have affected organization performance of internet service providers in Kenya positively.

Kihara (2019) investigated the influence of disruptive innovation on firm performance of taxi operators in Kenya. The study was anchored on the disruptive innovation theory. A descriptive research design was used, involving 18 corporate traditional taxi providers and 13 mobile phone applications' based taxi providers operating in the city of Nairobi. The respondents were employees of these taxi operators, including management. Data was collected through filling out of questionnaires by employees of both the incumbent and mobile phone applications' based taxi companies. The data was analyzed through regression analysis and the descriptive statistics. The outcomes revealed that performance of incumbent taxi providers was negatively affected by the introduction of disruptive innovation.

2.5 Summary of the Literature Review

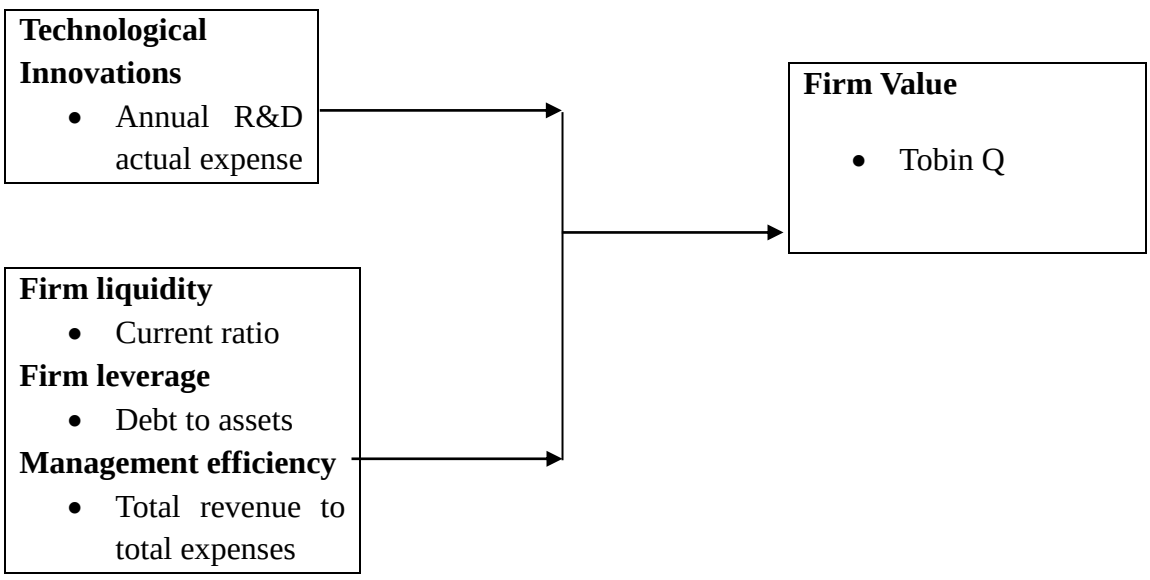
A number of theories have described how technological innovations and the value of firms relate. The theories covered in this review are; disruptive innovation theory, diffusion of innovation theory and technology acceptance model. A number of the critical firm value influencers have also been explored. Various empirical studies have been done both globally and domestically on technological innovations and value of firms. The results from those studies have also been reviewed in this section.

From the foregoing, it is clear that although there are many studies done locally, majority of them focused on related variables but did not address the relationship between technological innovations and value of firms. The local studies include Kiggima (2018), Mutie (2018), Waweru (2018), Ekuam (2019), Kihara (2019) among others. This study seeks to fill the research gap by answering: What is the effect of technological innovations on the value of firms listed at the NSE?

2.6 Conceptual Framework

The model illustrates the expected association between variables. The independent variable for the study was technological innovations measured as annual R&D actual expense as a proportion of annual sales. The control variables were liquidity, leverage and management efficiency. The dependent variable was firm value as measured by Tobin Q.

Figure 2.1: The Conceptual Model



Source: Researcher (2020)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In determining the effect of technological innovations on firm value, a study methodology was required in outlining how the research was done. This chapter outlines the research design, the data collection method, diagnostic tests and analysis methodology.

3.2 Research Design

The descriptive cross-sectional design was selected. Descriptive design was utilized since researcher wants to discover the current condition of the variables (Khan, 2008). The design was applicable since the researcher seeks to describe the nature of situations as they are (Khan, 2008). It was also suitable because the nature of the phenomenon being studied and how they relate is of major interest to him. Additionally, a descriptive research validly and accurately represents the variables which aid in providing a response to the study query (Cooper & Schindler, 2008).

3.3 Population

Burns and Burns (2008), define a population as the number of all of the observations of interest within a particular collection such as people or events as described by an investigator. The population comprised of 9 NSE listed manufacturing firms as at 31st December 2019 (see Appendix I). Because the population was small, no sampling was conducted.

3.4 Data Collection

Published annual reports of the firms being studied were drawn from Capital Markets Authority and individual firm's annual reports between January 2015 and December

2019 and provided secondary data which was recorded in a data collection sheet. The specific data collected included market value of equity, book value of equity, total R&D expense, total sales, total assets, net income, equity, current assets, current liabilities, total expenses and total debt.

3.5 Data Analysis

SPSS version 23 was used in analysis. The researcher illustrated findings using graphs and tables. Descriptive statistics was the method that was used in summarizing the data obtained from the firms. Frequencies, measures of central tendency, percentages and dispersion were used in reporting the data which was in tabular forms. Multiple regressions, correlation, coefficient of determination and ANOVA were used for inferential statistics.

3.5.1 Diagnostic Tests

In determining the viability of the study model, the paper carried out several diagnostic tests, which included normality test, stationarity test, test for multicolinearity, test for homogeneity of variances and the autocorrelation test. Normality tests the presumption that the residual of the response variable have a normal distribution around the mean. The test for normality was done by the Shapiro-wilk test or Kolmogorov-Smirnov test. In the case where one of the variables was not normally distributed it was transformed and standardized using the logarithmic transformation method. Stationarity test was used to assess whether properties like mean, variance and autocorrelation structure vary with time. Stationarity was assessed using augmented Dickey Fuller test. In case, the data fails the assumption of stationarity, the study used robust standard errors in the model (Khan, 2008).

Autocorrelation measures how similar a certain time series is in comparison to a lagged value of the same time series in between successive intervals of time. This was measured by the Durbin-Watson statistic and incase the assumption was violated the study employed robust standard errors in the model. Multicollinearity occurs when an exact or near exact relation that is linear is observed between two or several predictor variables. Variance Inflation Factors (VIF) and the levels of tolerance were used. Any multicolinear variable should be dropped from the study and a new measure selected and substituted with the variable which exhibits co-linearity. Heteroskedasticity tests if the variance of the errors from a regression is reliant on the independent variables. The study assessed for heteroskedasticity using the Levene test and incase, the data fails the assumption of homogeneity of variances the study used robust standard errors in the model (Burns & Burns, 2008).

3.5.2 Analytical Model

The model below was used:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon.$$

Where: Y = Value of a firm given by market value of equity to book value of equity computed annually.

α =y intercept of equation.

$\beta_1, \beta_2, \beta_3, \beta_4$ =are the regression coefficients

X_1 = Technological innovations given by the ratio of actual R&D expense to total sales for every year

X_2= Firm liquidity given by current assets to current liabilities

X_3= Firm leverage given as total debt to total assets per annum

X_4= Management efficiency given by total revenue to total assets

ε =error term

3.5.3 Tests of Significance

Parametric tests were done by the researcher in establishing the model's statistical significance and that of its parameters. The F-test was applied in the determination of the significance of the general model using the Analysis of Variance (ANOVA) model and a t-test determined how significant the individual variables were.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND FINDINGS

4.1 Introduction

The chapter exhibits the data analysis from CMA to establish how technological innovations influences manufacturing firms' value. Through use descriptive statistics, correlation and regression analyses, results were then tabulated in subsequent sections.

4.2 Response Rate

This study endeavored to obtain data from the 9 NSE listed manufacturing firms as at 31st December 2019 for 5 years (2015 to 2019). Data was obtained from all the 9 firms but Mumias Company Limited had not published the 2019 results therefore giving a total of 44 observations instead of 45.

4.3 Descriptive Analysis

The result from this analysis is the maximum, average and minimum values of variables which include the standard deviations for the investigation. Table 4.1 illustrates the findings for the different variables. SPSS was utilized for this purpose for the selected period for the 9 manufacturing firms' data collected. The resultant values are tabulated below.

Table 4.1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Firm value	44	.1403	1463.7663	72.080148	264.6815598
Technological innovations	44	.0323	.0967	.064	.0487
Liquidity	44	.0290	9.4	2.070	1.8993
Firm leverage	44	.0970	1.9142	.570	.3310
Management efficiency	44	.0868	2.269	.966	.6857
Valid N (listwise)	44				

Source: Research Findings (2020)

4.4 Diagnostic Tests

The Researcher performed these tests were done on data selected. Multicollinearity test was performed. The investigation utilized the VIF and Tolerance in which values above 0.2 for Tolerance, and less than 10 for VIF indicated the absence of Multicollinearity. To use the multiple regressions a substantial association ought to be unavailable amongst the independent variables. Results indicated tolerance values greater than 0.2 and VIF below 10 for the variables as tabulated in 4.2 which indicated the lack of Multicollinearity.

Table 4.2: Multicollinearity Test for Tolerance and VIF

	Collinearity Statistics	
Variable	**Tolerance**	**VIF**
Technological innovations	0.398	2.513
Liquidity	0.388	2.577
Leverage	0.376	2.659
Management efficiency	0.386	2.591

Source: Research Findings (2020)

Shapiro-walk and Kolmogorov-Smirnov confirmed normality. The Null hypothesis was on the assumption of no normal distribution among the data. A p-value more than 0.05, indicates that the null hypothesis would be rejected by the researcher. Table 4.3 shows the findings.

Table 4.3: Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Firm value	Statistic	Df	Sig.	Statistic	Df	Sig.
Technological innovations	.178	44	.300	.881	44	.723
Liquidity	.176	44	.300	.892	44	.784
Leverage	.173	44	.300	.918	44	.822
Management efficiency	.175	44	.300	.874	44	.812

a. Lilliefors Significance Correction

Source: Research Findings (2020)

The Kolmogorov-Smirnova and Shapiro-Wilk tests gave p-values above 0.05 that implied the presence of a normal distribution of data thereby rejecting the null hypothesis. This confirmed that the data was suitable to be applied for parametric testing such as Pearson's correlation, regression analysis and ANOVA.

Autocorrelation tests were run in confirming if error terms had a correlation overtime. This was accomplished using the Durbin Watson test. Statistic of 1.657 confirmed the inexistence of a serial autocorrelation because the value was between 1.5 and 2.5 which is acceptable.

Table 4.4: Autocorrelation Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.509[a]	.259	.183	.2542441	1.657

a. Predictors: (Constant), Management efficiency, Firm leverage, Technological innovations, Liquidity
b. Dependent Variable: Firm Value

Source: Research Findings (2020)

The nature of many variables is that they are mainly non-stationary before performing a regression analysis. The researcher hence did unit root tests using the Augmented Dickey-Fuller (ADF) in determining if variables utilized were stationary or not. This had the effect of preventing false regression resulting from the use of non-stationary series.

Table 4.5: Stationary Test

Variable name	ADF test	1% Level	5% Level	10% Level	Prob
Value	-3.753547	-4.23497	-3.540328	-3.202445	0.0312
Technological innovations	-4.262276	-4.23497	-3.540328	-3.202445	0.0093
Liquidity	-4.522157	-4.23497	-3.540328	-3.202445	0.0420
Management efficiency	-3.98997	-3.55267	-2.91452	-2.59503	0.0043
Leverage	-2.78574	-2.25267	-1.53674	-1.04693	0.0381

Source: Research Findings (2020)

Table 4.5 illustrates variables being stationary at 1%, 5% and 10% significance with no differentiation of variables.

4.5 Correlation Analysis

This analysis determines if variables are related. The relationship found may lie amongst a (-) strong negative and (+) strong positive correlation. This was done by the use of Pearson correlation establishing how the firms' value and the independent variables are related.

Findings showed that technological innovations, liquidity and management efficiency had a positive but weak correlation with the manufacturing firms' value given by ($r = .047$, $p = .760$; $r = .190$, $p = .218$; $r = .278$, $p = .068$) simultaneously. Financial leverage exhibited a positive substantial correlation with firm value shown by ($r = .345$, $p = .022$). Although being related to some extent, the independent variables' relation was not substantial in confirming Multicollinearity because the r values were less than 0.70. This provided evidence of a non-existent Multicollinearity between the

predictor variables and thereby confirming that they were sufficient in determining firm value in the regressed model.

Table 4.6: Correlation Analysis

		Firm value	Tech. innovations	Liquidity	Firm leverage	Management efficiency
Firm value	Pearson Correlation	1				
	Sig. (2-tailed)					
Tech. innovations	Pearson Correlation	.047	1			
	Sig. (2-tailed)	.760				
Liquidity	Pearson Correlation	.190	.220*	1		
	Sig. (2-tailed)	.218	.000			
Firm leverage	Pearson Correlation	.345*	.394*	.334*	1	
	Sig. (2-tailed)	.022	.008	.000		
Management efficiency	Pearson Correlation	.278	.032	.269	.020	1
	Sig. (2-tailed)	.068	.838	.078	.897	

*. Correlation is substantial at the 0.05 level (2-tailed).
**. Correlation is substantial at the 0.01 level (2-tailed).

c. Listwise N=44

Source: Research Findings (2020)

4.6 Regression Analysis

The variables against which firm value was regressed were; technological innovations, liquidity, leverage and management efficiency. Analysis was done at 5% significance. Critical value given by F – table was contrasted with the regression figure. The statistics are tabulated in 4.7 below.

Table 4.7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.509[a]	.259	.183	.2542441	1.657

a. Predictors: (Constant), Management efficiency, Firm leverage, Technological innovations, Liquidity
b. Dependent Variable: Firm Value

Source: Research Findings (2020)

R square alternatively referred to the coefficient of determination indicates changes in the response variable as a result of changes from predictor variables. From results in table 4.7 above, R square was 0.259, meaning that 25.9% variations in value of manufacturing firms are caused by technological innovations, liquidity, leverage and management efficiency. Alternate variables outside the model are responsible for 74.1% variations in value. Additionally the independent variables had a moderate relationship with firm value given by a 0.509 correlation coefficient (R). A durbin-watson statistic of 1.657 indicated that the variable residuals showed no serial correlation because it was greater than 1.5.

Table 4.8: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.881	4	.220	3.407	.018[b]
	Residual	2.521	39	.065		
	Total	3.402	43			

a. Dependent Variable: Firm value
b. Predictors: (Constant), Management efficiency, Firm leverage, Technological innovations, Liquidity

Source: Research Findings (2020)

The significance figure is 0.018 which is below p=0.05. This indicates the sufficiency of the model in predicting how technological innovations, liquidity, leverage and management efficiency influence value of NSE listed manufacturing firms.

Coefficients of determination were employed to indicate direction of the relation amongst the predictor variables and the manufacturing firms' value. The p-value under sig. column was employed to indicate how significant the relation between the response and the predictor variables are. The 95% confidence level, implies a p-value lower than 0.05. Consequently, a p-value that is higher than 0.05 shows an insignificant association amongst the predictor and response variable. Results are tabulated in 4.9 below.

Table 4.9: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.120	.185		-.647	.521
	Technological innovations	.832	.944	.133	2.521	.017
	Liquidity	.044	.009	.497	4.919	.000
	Firm leverage	.274	.155	.322	1.764	.086
	Management efficiency	.137	.060	.335	2.274	.029

a. Dependent Variable: Firm value

Source: Research Findings (2020)

From the findings, with the exception of financial leverage, the other variables produced positive substantial values (high t-values, $p < 0.05$). Financial leverage produced positive but weak value as shown by a p value of higher than 0.05.

The equation below was determined:

$Y = -1.120 + 0.832X_1 + 0.044X_2 + 0.137X_3$

Where,

Y = Firm value

X_1= Technological innovations

X_1= Liquidity

X_1= Management efficiency

On the above model, the constant = -1.120 indicates that if the independent variables (technological innovations, liquidity, leverage and management efficiency) were at zero, firm value would be -1.120. A unit increase in technological innovations, liquidity or management efficiency would increase firm value by 0.832, 0.044 and 0.137 respectively while financial leverage was not significant.

4.7 Interpretation and Discussion of Research Findings

The study's intent was to assess how technological innovations influence value of manufacturing firms listed at NSE. Technological innovations was the dependent variable given by the ratio of R&D expenditure to total sales revenue. The control variables included liquidity which was current ratio, management efficiency by total revenue to total assets and leverage by debt to assets ratio. Firm value was response variable given by Tobin Q.

The Pearson correlation coefficients uncovered that leverage has a positive substantial correlation with value of manufacturing firms. Findings discovered a positive but weak correlation amongst leverage and management efficiency with firm value of NSE listed manufacturing firms. Technological innovations exhibited a positive but not substantial relation with value of NSE listed manufacturing firms.

The summary showed that the predictor variables: technological innovations, liquidity, leverage and management efficiency explains 25.9% changes in response variable as shown by R^2 implying that different factors outside the model explain the 74.1% changes in value. The model was sufficient at 95% confidence with an F-value is 3.407. This shows that it was appropriate in explaining how the independent variables impact listed manufacturing firms' value.

Findings agree with Kiggima (2018) who sought to examine how technological innovation impacts enterprise performance of Micro and Small Enterprises (MSEs) in Nairobi County, Kenya. The target population consisted of MSEs from different sectors. The study took 10% of the target population of 1539 hence obtaining a sample of 155 MSEs as respondents. Primary data was selected for the study. Data was analyzed using descriptive and inferential statistics. The study concluded that adoption of technological innovations gave the MSEs a competitive edge which boosted their performance.

The findings are also in line with Zhang et al. (2018) who investigated the effect of innovation on the value of a company. The focus of the study was on Baltic listed companies from the year 2005 to 2011. From the study findings, innovative companies were found to have a higher value and were significantly larger. Within such companies, they observed that higher value was achieved when the proportion of intangible assets was greater than 1%. By utilizing correlation and multiple regression they found that innovation was crucial in determining company value. The recommendations made by the researchers was that company should make investments in the process of innovation because it raises company value.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, derived conclusions, and limitations encountered in the investigation. It also recommends policies that will be useful to policy formulators in improving the expectations of listed manufacturing firms regarding the improvement in firm value. Additionally, will give suggestions for future researchers.

5.2 Summary of Findings

The research objective was to assess how technological innovations influence firm value of NSE listed manufacturing firms. The selected variables for investigation included technological innovations, liquidity, leverage and management efficiency. A descriptive cross-sectional design was chosen in completing the study. Secondary data was collected from the CMA and analyzed using SPSS. Yearly data for 9 manufacturing firms from 2015 to 2019 was sourced from the manufacturing firms' reports.

From the correlation, financial leverage had a substantial positive relationship with value of manufacturing firms. It also showed a positive but weak correlation between leverage, management efficiency and value of NSE listed manufacturing firms. Technological innovations exhibited a positive but not substantial association with value of NSE listed manufacturing firms.

From the results of regression analysis, R square was 0.259, meaning that 25.9% variations in value of NSE listed manufacturing are from variations in technological

innovations, liquidity, leverage and management efficiency. Factors outside the model account for 74.1% variations in value. The result was a moderate correlation between the selected predictor variables and manufacturing firms' value (R=0.509). ANOVA test showed that the F computed at 5% significance level was higher than the critical value while the p value was 0.018 suggesting that the model was statistically substantial in predicting the influence of the four selected independent variables on value of NSE listed manufacturing firms.

Regression findings show that when all variables (technological innovations, liquidity, leverage and management efficiency) were rated zero, firm value would be -1.120. A unit increase in technological innovations, liquidity or management efficiency would increase firm value by 0.832, 0.044 and 0.137 respectively while financial leverage was not found to be statistically significant.

5.3 Conclusion

Results show that the listed manufacturing firms' value is significantly influenced by technological innovations. It confirmed that a unit increase in this variable substantially increases the value of manufacturing firms. Firm liquidity had a positive substantial relation to value and hence increasing liquidity increases firm value to a significant extent. The study also showed that management efficiency was statistically significant in determining firm value and hence the study concluded that management efficiency has a profound effect on value of listed manufacturing firms. Further, the study found that financial leverage has a positive but not statistically significant influence on financial performance hence concluding that leverage is not a significant determiner of financial leverage.

The conclusion is that the independent variables selected;technological innovations, liquidity, leverage and management efficiency significantly influence on the value of NSE listed manufacturing firms. These variables notably impact the value of manufacturing firms given that the p value in ANOVA is less than 0.05. The fact that that the independent variables account for 25.9% variations in firm value implies that 74.1% of variations in value of manufacturing firms are because of other factors not considered in the model.

This study agrees with the findings of Irina and Elvira (2015) who attempted to examine the influence that technological innovation have on value of a firm. Utilizing data originating from a company's patenting activities, they were able to construct a profile that consisted of the generation, dissemination and strength of a firm's innovations. The main goal of the study was to predict the firm's market value using the dimensions of technological innovation using panel data analysis. 10 year cross sectional, longitudinal data from a firm's innovation profile was used together with lagged measurements of market value. The study found that innovative companies generally have a higher value and are significantly larger.

This study also agrees with Waweru (2018) who aimed on investigating the impact that innovations had on the performance of NSE listed agricultural firms. A qualitative survey technique was used in the study. The study utilized primary data obtained by use of an interview guide. The qualitative analysis was performed using content analysis. This was done in evaluating the responses, drawing conclusions and deriving recommendations. From the findings, it was concluded that appositive relation exists between technological capability and firm performance.

5.4 Recommendations

Findings showed that the relation between technological innovations and firm value as positive and substantial. Recommendations for policy changes from this investiation include: NSE listed Manufacturing firms should invest on technological innovations to enhance firm value. The study also recommends that listed manufacturing firms should lay infrastructure as well as purchase technological equipment that are needed to fast-track adoption of innovations. This would help them to position themselves in readiness for adoption of new technology as technology is changing constantly. This would thus help increase their competitiveness both locally and internationally and in essence boosting their firm value.

A positive relation between firm value and liquidity was found. A thorough assessment of NSE listed manufacturing firm ought liquidity position to be done to make sure the companies operate at adequate liquidity levels thereby improving value. The reason is that a liquidity is highly important as it impacts firm operations.

Management efficiency had a significant positive influence on value of NSE listed manufacturing firms. The recommendation is that manufacturing firms should develop best talent management strategies to ensure attraction and retention of talented and dedicated employees as this will go a long way in enhancing firm value. Some of the talent management practices they should pay keen attention are workforce planning, recruitment, learning and development and employee rewards and compensation.

5.5 Limitations of the Study

This study focused on some factors that are hypothesized to influence value of NSE listed manufacturing firms. Specifically, the study focused on four explanatory

variables. In reality however, there are other variables that are likely to influence value of firms some which are internal such as firm size and age of the firm while others are not under the control of management such as economic growth exchange rates, balance of trade, and unemployment rate among others.

The study adopted the analytical approach which is highly scientific. The research also disregarded qualitative information which could explain other factors that influence the association between technological innovations and value of manufacturing firms. Qualitative methods such as focus group discussions, open ended questionnaires or interviews can help develop more concrete results.

The research concentrated on 5 years (2015 to 2019). It is not certain whether the findings would hold for a longer time frame. It is also unclear as to whether similar outcomes would be obtained beyond 2019. The study should have been executed over a longer time frame in order to incorporate major forces such as booms and recession.

In completing the data analysis, multiple linear regression model was used. Because of the drawbacks associated with using the model like errors and misleading results as a result of a change in variable value, the findings cannot be generally applicable to all areas. If data is added to the model, it may not produce the same result.

5.6 Suggestions for Further Research

The investigation focused on how technological innovations impact value of NSE listed manufacturing firms using secondary data. Similar investigations made using primary data obtained through the use of in depth questionnaires and interviews on all the firms would complement this investigation.

This investigation did not consider all the factors that impact the value of NSE listed manufacturing firms hence recommends that subsequent studies be conducted on other macroeconomic variables. By investigating how each of these variables impact firm value, policy makers can then use an appropriate tool in controlling firm value.

The research only focused on the manufacturing firms listed at the NSE. The study's recommendations are that further studies be carried out on other firms operating in Kenya. Future studies can also focus on how technological innovations influence other aspects other than firm value such as financial inclusion, poverty eradication and overall economic growth.

The attention of this study was drawn to the latest five years because it was the readily available information. Subsequent studies may cover big time frame like ten or twenty years which can be very impactful on this study by either complementing or disregarding the findings of this study. The advantage of a longer study is that it will enable the researcher to capture effects of business cycles such as booms and recessions.

Finally, this study was based on a multiple linear regression model, which has its own limitations for instance erroneous and misleading outcomes resulting from a change in variable value. Future researchers should focus on other models like the Vector Error Correction Model (VECM) in exploring the various relations amongst technological innovations and firm value.

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APPENDICES

Appendix I: Manufacturing and Allied Firms Listed at the NSE

1. B.O.C Kenya Ltd
2. British American Tobacco Kenya Ltd
3. Carbacid Investments Ltd
4. East African Breweries Ltd
5. Eveready East Africa Ltd
6. Flame Tree Group Holdings Ltd
7. Kenya Orchards Ltd
8. Mumias Sugar Co. Ltd
9. Unga Group Ltd

Appendix II: Research Data

COMPANY	Year	Firm value	Firm leverage	Liquidity	Management efficiency	Technological innovations
BAT	2019	5.1466	0.5571	1.0870	1.8156	0.0654
	2018	8.8537	0.4924	1.5911	1.9901	0.0765
	2017	10.0526	0.8749	1.3180	1.9358	0.0856
	2016	8.1509	0.8488	1.4132	1.9825	0.0567
	2015	6.2844	0.4892	1.4512	1.9173	0.0678
Carbacid	2019	0.6535	0.1072	5.6940	0.1800	0.0453
	2018	1.2941	0.0970	9.4280	0.1677	0.0456
	2017	1.6217	0.1158	7.0132	0.1782	0.0357
	2016	2.9377	0.1323	7.0885	0.2699	0.0458
	2015	13.6027	0.1656	4.5106	0.2727	0.0425
Eveready	2019	2.1000	0.5574	1.5019	0.7672	0.0344
	2018	1.7000	0.2372	2.5325	0.4387	0.0546
	2017	1.3914	0.2890	2.6948	0.4387	0.0343
	2016	1.4706	0.5506	0.4538	0.5110	0.0452
	2015	0.6720	0.4666	0.8578	0.7489	0.0356
Unga Group	2019	0.4251	0.4312	1.9559	1.6810	0.0323
	2018	0.4647	0.4353	2.1418	2.0118	0.0345
	2017	0.6507	0.5064	1.6579	2.0654	0.0385
	2016	0.4653	0.4194	2.2986	2.2688	0.0342
	2015	0.2261	0.3824	2.3685	2.1591	0.0450
BOC Kenya	2019	0.7868	0.2776	1.9772	0.4897	0.0612
	2018	1.1950	0.2908	1.8821	0.4513	0.0678
	2017	1.5344	0.2770	1.9539	0.4342	0.0633

COMPANY	Year	Firm value	Firm leverage	Liquidity	Management efficiency	Technological innovations
	2016	1.6807	0.2366	2.2831	0.4842	0.0712
	2015	1.2927	0.2615	2.0635	0.5112	0.0675
EABL	2019	7.5871	0.8145	0.8795	0.9481	0.0967
	2018	18.4600	0.8365	0.8349	1.0310	0.0862
	2017	19.6291	0.8202	1.0069	1.0537	0.0756
	2016	20.6343	0.8878	0.7707	1.0417	0.0657
	2015	18.8553	0.7937	1.0229	0.9624	0.0712
Mumias	2018	-0.1403	1.9142	0.0290	0.0876	0.0653
	2017	4.2317	0.9686	0.1093	0.0868	0.0653
	2016	0.5357	0.7179	0.1807	0.2345	0.0754
	2015	1.0619	0.7097	0.1879	0.2707	0.0623
FTG Holdings	2019	0.6513	0.5366	1.2125	1.0629	0.0712
	2018	1.8878	0.5580	1.1436	1.3530	0.0700
	2017	2.7205	0.5648	1.2907	1.4428	0.0654
	2016	2.5778	0.5272	1.5305	1.6728	0.0765
	2015	3.1706	0.5613	1.6410	1.7211	0.0864
Kenya Orchards	2019	34.4845	0.7601	1.9784	0.4412	0.0435
	2018	51.9707	0.7884	2.1138	0.6305	0.0560
	2017	566.3936	0.8577	1.7132	0.6806	0.0512
	2016	878.3952	0.8909	2.0214	0.7237	0.0454
	2015	1,463.7663	0.9235	2.0757	0.7745	0.0543