EFFECT OF INFORMATION TECHNOLOGY INTEGRATION ON LEAN PRODUCTION: A CASE OF NESTLÉ KENYA

SUSAN MBULA

REG NO: MBA/110659/2018

A RESEARCH DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION (MBA) AT STRATHMORE UNIVERSITY

OCTOBER 2020

DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the thesis/dissertation (use as appropriate) contains no material previously published or written by another person except where due reference is made in the dissertation itself.

Name of Candidate: Susan Mbula

Signature: 

Date: 22nd October 2020

Approval

The dissertation of Susan Mbula was reviewed and approved for examination by the following:

Dr. Vincent Omwenga, PhD.
Academic Director
Faculty of Information Technology Strathmore University

Dr. George Njenga
Executive Dean
Strathmore University Business School.

Dr. Bernard Shibwabo
Director, Office of Graduate Studies

ABSTRACT

Lean production in the business improves productivity and competence by that business stability and profitability can be achieved as per the recent trends in the business management and technology. Lean production cannot achieve the organizational goals alone. it need some support such as strategic planning. leadership and technology. Successful lean implementation can be done by using the information technology in enterprise, by integrating the lean and IT, misalignment can be eliminated which results in exact product output with least waste. By integrating lean and IT. an enterprise maintains their financial data, client orders and purchasing. The broad research objective was to investigate the effect of information technology integration on lean production in Nestle' Kenya. Specific objectives included; determining the effect of internal IT integration and external IT integration on lean production in Nestle' Kenya, and also determining the role of knowledge management on the two relationships. An ex post facto and causal research design was adopted because it established the cause and effect relationship. The target population were all the employees of Nestle Kenya, numbering 70. The study employed primary data which was collected by use of a close ended questionnaire. It was a case study because entailed analyzing one firm, Nestle' Kenya. It was a cross-sectional study since data was collected across several units in a uniform time-frame. Data was analyzed through SPSS and interpretation through quantitative methods as per objectives and questions of the research. The study utilized descriptive statistics to gauge the existence of IT integration and utilization of lean management in Nestle' Kenya. The researcher employed inferential statistics. which included correlation analysis, simple linear regression, and hierarchical multiple linear regression to analyze data collected during the study. The study established that there is a significant association and relationship between both internal and external IT integration and lean production. Finally. the study established that knowledge management does not play a significant moderating role on the two relationships. The study established that internal IT integration had a positive significant association with lean production implementation and a significant positive effect on lean production. The study makes recommendations to the policy makers in the ministry of trade and industrialization, KAM, KNCCI. other bodies, practitioners in the industrial sector, and consultants to implement both internal and external IT integration in order to boost LP implementation. Thus. the stakeholders should engage IT in human resource management, customer credit procedures. product development and research. risk management systems. and ERP systems. Additionally. they should engage IT in customer relationship management and marketing processes. In addition, they should divide lead-time in a supply chain into electronic ordering information lead-time and physical material movement lead-time. share demand and inventory data with suppliers/distributers to shorten the order processing lead time. and utilize IT systems in the procurement process to select the most appropriate supplier. The study makes further recommendations that there should also be focus on knowledge management when utilizing IT integration to augment lean production.

Key words: Lean Production, Information Technology, Internal IT Integration, External IT Integration, Knowledge Management

TABLE OF CONTENTS

DECLARATION ..... **ii**

ABSTRACT ..... **iii**

ABBREVIATIONS/ACCRONYMS ..... **xi**

DEFINITION OF KEY TERMS ..... **xii**

DEDICATION ..... **xiii**

ACKNOWLEDGEMENT ..... **xiv**

CHAPTER ONE: INTRODUCTION **1**

1.1 Background of the Study 1

1.1.1 Lean Production 2

1.1.2 Information Technology Integration 3

1.1.3 Lean Production and Information Technology Integration 4

1.1.4 Nestle' Kenya 5

1.2 Statement of the Problem 6

1.3 Research Objectives 8

1.3.1 General Objective 8

1.3.2 Specific Objectives 8

1.4 Research Questions 8

1.5 Scope of the Study 8

1.6 Significance of the Study 9

1.7 Limitations of the Study 9

CHAPTER TWO: LITERATURE REVIEW **11**

2.1 Introduction 11

2.2 Theoretical Review of Literature 11

2.2.1 Knowledge Based View 11

2.2.2 Theory of Constraints 12

2.3 Empirical Literature Review 13

2.3.1 Internal IT integration and Lean Production 13
2.3.2 External IT Integration and Lean Production 14
2.3.3 Knowledge Management, IT Integration, and Lean Production 15
2.3.4 Information Technology and Lean Production 17
2.4 Research Gap 18
2.5 Conceptual Framework 22
2.6 Operationalization of Study Variables 24
CHAPTER THREE: RESEARCH METHODOLOGY 25
3.1 Introduction 25
3.2 Research Philosophy 25
3.3 Research Design 25
3.4 Population 25
3.5 Data Collection 26
3.6 Data Analysis 26
3.6.2 Diagnostic Tests 27
3.7 Research Quality 29
3.7.1 Validity 29
3.7.2 Reliability 29
3.8 Ethical Issues in Research 30
3.9 Pilot Study Results 31
3.9.1 Pilot Test Process 31
3.9.2 Validity 31
3.9.6 Reliability 33
CHAPTER FOUR: DATA ANALYSIS, RESULTS AND INTERPRETATION 36
4.1 Introduction 36
4.2 Response Rate 36
4.3 Background and Respondent Characteristics 36

4.3.1 Job Position 37
4.3.2 Department 37
4.3.3 Gender 38
4.3.4 Age 39
4.3.5 Education Level 39
4.3.6 Employment Terms 40
4.3.7 Work Experience 40
4.4 Variables Descriptive Statistics 41
4.4.1 Internal IT Integration 41
4.4.3 External IT Integration 42
4.4.1 Knowledge Management 44
4.4.4 Lean Production Implementation 45
4.5 Diagnostic Tests 46
4.5.1 Normality Test 46
4.5.2 Test for Homoscedacity 47
4.5.3 Test for Multicollinearity 47
4.5.4 Tests for Autocorrelation 48
4.6 Inferential Statistics 49
4.6 1 Internal IT Integration and Lean Production 49
4.6.2 External IT Integration and Lean Production 51
4.6.3 Knowledge Management. IT Integration, and Lean Production 53
4.7 Discussion of Findings 58
4.7.1 Internal IT Integration and Lean Production Implementation 59
4.7.2 External IT Integration and Lean Production Implementation 60
4.7.3 IT Integration, Knowledge Management and Lean Production Implementation ... 61
CHAPTER FIVE: SUMMARY, DISCUSSIONS, CONCLUSIONS, AND RECOMMENDATIONS 63

5.1 Introduction 63
5.2 Summary 63
5.2.1 Internal IT Integration and Lean Production Implementation 63
5.2.2 External IT Integration and Lean Production Implementation 63
5.2.3 IT Integration, Knowledge Management, and Lean Production Implementation .. 63
5.3 Conclusion 64
5.3.1 Internal IT Integration and Lean Production Implementation 64
5.3.2 External IT Integration and Lean Production Implementation 64
5.3.3 IT Integration, Knowledge Management, and Lean Production Implementation .. 65
5.4 Recommendations 65
5.4.1 Internal IT Integration and Lean Production Implementation 65
5.4.2 External IT Integration and Lean Production Implementation 66
5.4.3 IT Integration, Knowledge Management, and Lean Production Implementation .. 66
5.5 Recommendations for Further Study 66
5.6 Limitations of the Study 67
REFERENCES 68
APPENDICES 74
Appendix I: Introduction Letter 74
Appendix II: Research Questionnaire 75
Appendix III: Budget 78
Appendix IV: Work plan 79

LIST OF TABLES

Table 2.1: Summary of Knowledge Gaps 19
Figure 2.1: Conceptual Framework 23
Table 2.2: Operationalization of Study Variables 24
Table 3.1: Analytical Statistical Models, and Interpretation of Results 28
Table 3.2: Chronbach's Rule on Internal Consistency 30
Table 3.3: Pilot Study Response Rate 31
Table 3.4: Validity for Internal IT Integration 32
Table 3.5: Validity for External IT Integration 32
Table 3.6: Validity for Knowledge Management 33
Table 3.7: Validity for Lean Production Implementation 33
Table 3.8: Summary Reliability Table 34
Table 3.9: Reliability Statistics for Internal IT Integration 34
Table 3.10: Reliability Statistics for External IT Integration 34
Table 3.11: Reliability Statistics for Knowledge Management 34
Table 3.12: Reliability Statistics for Lean Production Implementation 35
Table 4.1: Study Response Rate 36
Table 4.2: Job Position 37
Table 4.3: Department Worked In 38
Table 4.4: Gender 38
Table 4.5: Age 39
Table 4.6: Education Level 39
Table 4.7: Employment Terms 40
Table 4.8: Work Experience 40
Table 4.9: Internal IT Integration Descriptive Statistics 42
Table 4.10: External IT Integration Descriptive Statistics 43
Table 4.11: Knowledge Management Descriptive Statistics 44
Table 4.12: Lean Production Implementation Descriptive Statistics 45
Table 4.13: Normality Test 46
Table 4.14: Test for Homoscedacity 47
Table 4.15: Multicollinearity Statistics 48
Table 4.16: Autocorrelation Test 48
Table 4.17: Correlation Analysis 49
Table 4.18: Model Summary 50

Table 4.19: Analysis of Variance 50
Table 4.20: Model Coefficients 51
Table 4.21: Correlation Analysis 52
Table 4.22: Model Summary 52
Table 4.23: Analysis of Variance 52
Table 4.24: Model Coefficients 53
Table 4.25: Model Summary 54
Table 4.26: Analysis of Variance 55
Table 4.27: Model Coefficients 55
Table 4.28: Model Summary 56
Table 4.29: Analysis of Variance 57
Table 4.30: Model Coefficients 57

LIST OF FIGURES

Figure 2.1: Conceptual Framework 23

ABBREVIATIONS/ACCRONYMS

ERP	-	Enterprise Resource Planning
ICT	-	Information Communication Technology
IS	-	Information System
IT	-	Information Technology
JIT	-	Just-in-Time
KAM	-	Kenya Association of Manufacturers
KNCCI	-	Kenya National Chamber of Commerce and Industry
LP	-	Lean Production
MRP	-	Material Requirements Planning
SMED	-	Single Minute Exchange Die
TOC	-	Theory of Constraints
TPM	-	Total Productive Maintenance
TQM	-	Total Quality Management

DEFINITION OF KEY TERMS

Lean Production	Lean manufacturing is a methodology that focuses on minimizing waste within manufacturing systems while simultaneously maximizing productivity (Narasimhan et al., 2006). Lean production includes practices such as quick changeover techniques, kanban systems, and lot-size reduction. A good lean production system produces high-quality products at the pace of customer demand with little waste. It allows customers to be served with less inventory investment and a higher level of responsiveness (Womack, Jones, & Roos, 1990; Womack & Jones, 1996).
Information Technology	IT is combination of microelectronics, computing (hardware and software), telecommunications, broadcasting and optoelectronics (Castells, 1996). IT is a group of technologies used to disseminate, store and process information enabling the execution of information-related human actions, and serving both public institutions and the private sectors (Vine, 2012). IT is a general term that is used to define merging of a wide collection of new technologies presently being used in the creation, processing and transmission of information within corporations as well as between traders in the business to business relationship (Lai, 2011).
Internal IT Integration	Internal integration in essence refers to information sharing between internal functions, strategic cross-functional cooperation, and working together (Bharadwaj, 2000). Internal IT integration can be used to generate information and facilitate information sharing within the firm, which can enhance a firm's production capabilities (Schlie & Goldhar, 1995; Small, 1999).
External IT Integration	External IT integration refers to unified control of functions and processes across trading partners using computer systems. External IT integration can either be upstream or downstream. Upstream examples include the sharing of production plans and costs with suppliers, while downstream examples include the various shared information and processes associated with collaborative planning, forecasting and replenishment (Germain & Iyer, 2006).
Knowledge Management	Knowledge management is the process of creating, sharing, using and managing the knowledge and information of an organization (Sison, 2006). Identifying, capturing, retrieving, sharing, and evaluating an enterprise's information assets can be done through an integrated approach, which is aided by knowledge management sponsor (Hicks, Gallup & Dattero, 2006).

DEDICATION

To my husband Kennedy, daughter Yvette and brother Paul, you have been my biggest fans throughout this journey and am truly blessed to have you guys in my life.

I equally dedicate the report to my late loving mother, Catherine Mueni Nzuki. You shined so bright on us and through you we experienced love, care and the best mother one could ever wish for. Thank you for believing in me and teaching me to always hold unto the Lord's unchanging hands.

ACKNOWLEDGEMENT

I wish to acknowledge the Almighty God for the gift of wisdom, life and sound intellect to undertake this research successfully

I wish to give special thanks to my Husband, Kennedy Makanga Kiilu, for being the greatest source of positivity and encouragement throughout all the stages of the research. To my princess Yvette Mueni for being the biggest source of Joy during this process.

I am indebted to my supervisor Dr. Vincent Omwenga for his guidance and monumental support enabling successful completion of this study.

Thank you.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Lean production is a method to managing that emphasizes on waste deduction, while warranting value. This production approach can be implemented in every aspect of a professional ranging from design, production and distribution (Bell, 2005). Lean manufacturing is all about making processes and structures better in an organization through eliminating product and process wastes that consequently reduce costs (Manville, Greatbanks, Krishnasamy & Parker, 2012). This approach of production was devised in the industrial plants of Japan. Presently though lean production is implemented well beyond huge and urbane manufacturing undertakings. Toyota, a leading company in lean production, pioneered the identification of diverse types of waste that can be implemented in every business processing. Lean production main aspects as per Stone (2012) include; time based administration, just in time production (JIT), Kaizen (continuous improvement), concurrent engineering, and quality development and administration.

Lean Production (LP) incorporated with Information Technology (IT) improves the presentation of industry businesses. Lean production emphases on decreasing waste and improving quality. Lean-IT produces the level of info and material flow through the business. This can be attributed to new IT packages like Enterprise Resource Planning (ERP) together with Material Requirements Planning (MRP), which have been presented to the worldwide marketplace to create the business operations more effectual and operational (The Boston Consulting Group, 2012). Lean presentation can be enhanced by IT backing: Lean-IT pinpoints the significant constituents of info system in the business for smooth data movement as per Bell (2005).

Lean production in an organization enhances efficiency and capability of an enterprise. In addition, steadiness and productivity attained according to the current developments in the enterprise administration and expertise. LP cannot attain business objectives solely: it requires some backing like for example strategic scheduling, governance and technology. Effective lean execution can be achieved by use of IT in an organization by incorporating the lean plus IT misalignment can be eradicated that leads in precise product output with minimum waste, the precise expertise required to evade the misunderstanding amongst lean together with IT is one or the other MRP or ERP. By incorporating lean together with IT, a

company preserves their fiscal information, customer orders plus purchasing (Staats, Brunner & Upton, 2011). IT that is lean is utmost valuable in monitoring and development of business performance. Changes in the industry surroundings can be without difficulty implemented by lean-IT with enhanced presentation. In current seminars world-class organizations that include Schefenacker, Magal Engineering, James Walker together with Johnson Controls established that lean-IT has a positive influence on their company business. Key benefits of lean-IT they saw include transparency throughout the supply chain; elasticity condensed lead-time together with improved production as per Found (2006). The present research sought to investigate the effect of information technology on lean production and is going to conduct a case study of Nestle' Kenya.

1.1.1 Lean Production

Lean production is a process that focuses on minimizing waste within manufacturing schemes while concurrently maximizing output (Narasimhan, Swink & Kim, 2006). Organizations adopt lean production practices that are responsive to business needs and deliver positive outcomes to all stakeholders. A lean organization is created when provision of goods and services is achieved with fewer resources. Customers desire consistent value from products and services that can result from application of lean management practices supported by simple tools and processes (Juran & Godfrey, 1998). Lean production activities comprise practices like rapid change over techniques, kanban systems, and lot-size decrease. A decent lean production system manufactures high-grade produces at the speed of client request with little waste as per Womack, Jones, and Roos (1990) and Womack and Jones (1996). It permits clients to be attended to with less inventory savings and a developed level of receptiveness.

In today's business environment, lean focuses on value rather than cost issues, which largely signifies a more strategic and general approach that is less specific and tactical. This therefore makes the lean concept less dependent on the context and hence suitable for application in enhancing operational efficiency in both manufacturing and service delivery organizations. Successful implementation of lean production aspects like value streaming mapping, total quality management and lean leadership requires strong management commitment and support considering that lean is an ongoing program that needs time to implement (Womack et al., 1990; Hines et al., 2004; Holweg, 2007). LP consequently assists in minimized inventory levels and minimized lot sizes, that consequently advance the properness of process

response and minimize movement material period per (Fullerton, McWatters & Fawson, 2003; Li, Rao, Ragu-Nathan, 2005).

The basic principle of LP is a sequence of practices as per (Karlsson & Ahlström, 1996; Shah & Ward, 2007; Hopp & Spearman, 2004). It entails a tall level of agreement to recognize the utmost distinctive doings related with lean production adoption in the cases stated as per McLachlin (1997) and Narasimhan et al. (2006) as follows: Just-in-Time (JIT) production, Total Quality Management (TQM, Single Minute Exchange Die (SMED), Kanban and Total Productive Maintenance (TPM).

1.1.2 Information Technology Integration

As per Castells (1996), "IT is combination of microelectronics, computing (hardware and software), telecommunications, broadcasting and optoelectronics". According to Vine (2012), IT is a group of technologies used to disseminate, store and process information enabling the execution of information-related human actions and serving both public institutions and the private sectors. In addition, IT is a general term that define merging of a wide collection of new technologies presently being used in the creation, processing and transmission of information within corporations as well as between traders in the business-to-business relationship (Lai, 2011). IT greatly affects the modern business environment: it focuses on data and information storage (Rahrovani & Pinsonneault, 2012).

A vast scope of info is created and implemented in the design, production, and implementation of a produce. Client wants content and to meet environmentally friendly necessities. Therefore, it is logical to presume that the usage of information technology could facilitate considerable developments in the operation, business, and efficiency of info-intensive industrialized procedures plus doings, greatly by enabling their incorporation according to McKinsey & Company (2016). Apparatus and postings inside factories, the whole manufacturing businesses, and systems of suppliers, associates, and clients situated during the course of the world, can be more efficiently linked and integrated via the usage of IT (Orzen & Paider, 2015)

According to Moschella (1997), the core benefit of IT is it enhances the extent of info that is stored and processes. As per Vu (2013) Information Communication Technology (ICT) improves an organization's proficiency together with effectiveness by stimulating improved

communications together with relations with clients, permitting for budget saving and develops growth and presentation. IT greatly affects the modern business environment. The business world today has been highly impacted by applications of IT as a pillar of success, which facilitate good customer reach, fast changes to suit ever-changing customer requirements and understanding of good practice in the global business arena (Beamon, 2009). Globally, information flows through IT platforms which advise production planning, manufacturing and distribution among enterprises is rapidly changed by the IT. According to Denni (2012), it is imperative that every corporation adopts ICT for its own good. This enables the industries to do business globally through enhanced competence, and closer consumer and entrepreneur relationships (Chong, 2011).

IT mainly includes the aspects of knowledge management, internal IT incorporation in addition to exterior IT incorporation. Knowledge management is recognizing, seizing, re-claiming, and distribution together with assessing a business's information properties by use of an integrated methodology. These resources entail: databases, strategies plus measures or any other info that has not documented and workers have this information in their memory (Hicks, Galup, & Dattero, 2006). Data administration can be implemented via tools that include; Database Management Systems (DMS), Computer-Mediated Communication (CMC), asynchronous e-mails and dialogue settings, and synchronous-chat and conferencing as per Sison (2006). Interior integration links the various purposes in an organization like manufacturing, procuring together with materials administration. Internal integration particularly intended to improve the presentation of cross-functional procedures that encompasses the order-to-cash development. As per Davenport (1998), ERP systems are instances of IT intended to attain internal integration level. Frohlich (2002) opine that external integration denotes to info systems that associate an organization with its dealers and clients.

1.1.3 Lean Production and Information Technology Integration

All businesses want to acquire more profits by rivalry with fellow businesses and organizations in the worldwide marketplace. To attain this objective organization follows various plans as a company. Strategies ought to in the end bring satisfaction of clients, reduce the waste in businesses together with delivering high-quality produce. Companies will turn into more effectual and profitable organizations by eradicating waste and non-value extra doings in the procedure together with the administration. The remaining is minimized by

employing the lean production ideologies and skills in the business, minimizing waste while making use of the available human resource to maximum extend plus introducing the expertise into the enterprise operations like ICT structures. As per SAP (2007), by focusing on constant technological development and by building up the business technology expertise may establish new clients together with rise consumer value. An ERP system is the recommended technology tool in developing the company's operations. while enterprise software associations with lean methods could outcome in apparent observing on inventory. It consequently makes instant reply to customer's order alterations, know-how and lean assimilation permits corporate intelligence and untreatable administration.

By introducing IT in lean production. procedures would start being more effective, that finding would lead to easiness to comprehend client needs together with their wants and task to attain expectation of the client would become stress-free. Combination of IT and lean production gives an ordinary business procedure that could be assessed from stint to stint and be enhanced. According to SAP (2007), data together with information circulation in a business offers real time management. Furthermore, it triggers the significant aspects which play a vital part in lean production like for example business intelligence together with business analytics.

As per Bell (2005). "lean and IT in the organization would result in increase in productivity and reduction in waste in the organization which is very useful in the continuous improvement and free flow if knowledge in the enterprise. At the same time if the Information System (IS) is not realistic, it burdens operations and causes overproduction and waste". Bell (2005) further states as follows that if lean-IT is not correctly employed. instead of rise in output and value, it could be a burden to the company instead hence leading to upsurge in operating expenses and remaining. Thus, merely incorporating the innovative technologies and values would not bring constant development. The introduced know-hows together with the strategies ought to be executed accordingly to achieve positive findings in the field of production. quality and uninterrupted development.

1.1.4 Nestle' Kenya

Henri Nestlé, a Pharmacist who established a grain founded baby food formula for needy cases birthed Nestlé in 1866 (Nestlé, 2014). The transnational organization with its diverse brands set up a solid reputation worldwide for its quality items with "nourishment, wellbeing

and health" being the foundation of its operations in 83 nations (Nestlé, 2014). Nestlé Kenya Limited is an operating organization example under Nestlé East and Southern African Region. Nestlé East and Southern African Region was set up in 2017 after the closure of Nestle East African Region office headquarters in Nairobi. It has branches in over 23 countries. with its head office in South Africa. It oversees many countries with similar socio economic environment. In the year 1967, Nestlé Kenya Limited was established. The company factory is based in Nairobi. deliveries products to the native marketplace and exports to a couple of East African Countries. Nestlé Kenya Limited Head Office, Factory, together with its distribution center are located in Pate Road. Industrial Area, Nairobi as per Nestlé Company (2014).

Nyavie (2015) established that lean production was implemented in Nestlé and it in a positive way. affected warehousing management. The study also determined that Nestlé Ghana faced challenges with respect to ample expertise for warehousing computerization and discernibility, deprived warehouse outlines hindering higher outputs. nonexistence of IT capitals in secondary warehouse technology initiatives together with poor training sharing through sites and amongst companies. The frequently used lean tool in Nestlé was established to be the 5S model. This model systematically attempts to attain full discipline, orderliness. neatness, hygiene and standardization in the place of work hence bringing about safer, more productive together with more effective company warehouse. Work cells then followed which meant that Nestlé proficiently manufactured small batches of parts by use of specified grouping of individuals, machines. and resources. It was determined in addition that Nestlé every so often implemented the Kanban Pull method type of system.

Nestle Kenya production processes involve business process re-engineering where operations are structured around the overall procedure that adds importance to clients and not all about the purposes together with happenings that establish the value- adding doings. Additionally, Nestle Kenya processes also involve process time that involves flow of work passing from one person to the next. and for a larger process. from one department to the next (Magutu, Nyamwange & Kaptoge. 2010).

1.2 Statement of the Problem

Production in Nestle Kenya has faced several shortcomings which include: overexploitation of raw materials. anthropogenic effects. natural catastrophes together with climate change

that have presented a dire source of waste mostly at the supply point source (Magutu, Nyamwange & Kaptoge, 2010). Wamalwa, Onkware, and Musiega (2014) assert that the major challenges the manufacturers of food and beverages in Kenya have experienced with regards to adoption of Lean manufacturing to presentation optimization, are absence of tenacious and challenging governance, non-existence of a clear vision of the coming days together with what is possible to be attained, inability to connect the procedures in kaizen with regular work that is commonly viewed as a discrete package and not part and puzzle of everybody's official work, lack of endurance and following through, lack of perceiving that lean production is a feasible plan to assist attain competitive gain, disappointment to participate and include employees at every step in the process from initial stage, and a lack of continuous perceptibility by management on the shop floor.

Conceptually, LP principles and processes can be achieved effectively by simple means devoid of utilizing IT, or production may attain a high level of superiority if supported by IT (Riezebos et al., 2009). Nestle Kenya employs the *poka-yoke* mode of lean production without IT, which is a source error control system (Magutu, Nyamwange & Kaptoge, 2010). Nestle Kenya can evolve from utilizing simple human inspection components to complex computer vision systems centred on internal IT. IT also offers support to the maintenance role via an effective presentation monitoring and assessment, that can avert disruptions and suboptimal conduct (Riezebos et al., 2009).

On the global front Bruun and Meeford (2004) opine that IT integration can expedite lean practices. As per Ward and Zhou (2006), internal IT integration is linked with the employment and the application of operative lean production. Empirical study to test their hypothesis was not carried out in Bruun and Meeford (2004) research. Ward and Zhou (2006) research however, concentrated on the arbitrating influence of lean production on the association amongst IT integration and lead-time presentation. It was established that when lean practices are operational, the influence of ERP on lead-time is higher. Locally, Wamalwa, Onkware and Musiega (2014) investigated operational performance in Mumias Sugar Company and concluded that lean manufacturing tools such as mistake proofing, cause and effect diagram, load balancing as well as take time have a positive effect on performance.

There is a contextual gap in the global studies included in the study because they were not carried out in the Kenyan setting. There is also a knowledge gap because the studies analyzed

sub-components of IT and LP and did not examine them wholesomely. There is also a knowledge gap in the local studies highlighted because they do not analyze relationships between IT and LP principles and practices. There have been few studies that have analyzed the effect of IT on lean production. No study reviewed has endeavored to establish the effect of IT integration on lean production while utilizing knowledge management as a moderating variable. Thus, this study seeks to determine the effect of information technology on lean production by conducting a case study of Nestle' Kenya.

1.3 Research Objectives

1.3.1 General Objective

The general objective of the study was to investigate the effect of information technology integration on lean production in Nestle' Kenya.

1.3.2 Specific Objectives

The specific objectives of the study were:

i. To investigate the effect of internal Information Technology (IT) integration on lean production in Nestle' Kenya.
ii. To analyze the effect of external Information Technology (IT) integration on lean production in Nestle' Kenya.
iii. To review the moderating effect of knowledge management on the relationship between Information Technology (IT) integration and lean production in Nestle' Kenya.

1.4 Research Questions

i. What is the effect of internal Information Technology (IT) integration on lean production in Nestle' Kenya?
ii. What is the effect of external Information Technology (IT) integration on lean production in Nestle' Kenya?
iii. What is the moderating effect of knowledge management on the relationship between Information Technology (IT) integration and lean production in Nestle' Kenya?

1.5 Scope of the Study

The study focussed on the analysis of the relationship of information technology on lean production implementation at Nestle Kenya. Nestle Kenya is a multinational FMCG

production company; hence it was an ideal unit of analysis to study the impact of IT on lean production implementation. The aspects of information technology applied in the current study were; knowledge management, internal IT integration, and external IT integration. The study adopted an exploratory, ex post facto and causal research design. Primary data was obtained from the employees of the company. The study was expected to take two months because to the nature of the data collection on the population of the study. The study was cross-sectional: data was acquired from the various employees at a one-time period with the scope being a case study. It was a field setting with the unit of analysis being the firm. Inferential statistics and descriptive statistics were used in analyzing the quantitative data. Geographically, this study examined Nestle Kenya.

1.6 Significance of the Study

Outcomes from this research are important to stakeholders both at policy and management level. The findings and conclusions also served as a reference source in future research and studies as they seek to enhance knowledge on IT and the influence it has on LP. This study will make a great contribution to theories related to LP in industrial firms. Other researchers and academicians conducting studies on lean management practices in the industrial sector can obtain research material that can be used as empirical literature.

This study will direct policy makers in formulation of relevant policies that will guide and support the industrialization agenda contained in the Medium Term Plan Two (MTP2) and the Kenyan government Big Four Agenda that will drive the country towards Vision 2030, which will see the country, propelled to middle-income status. The utilization of IT to augment LP will advocate reduction of waste and increase in manufacturing output.

The management of Nestle' Kenya and other manufacturing firms together with management consultants would use this study as a basis of making informed decisions especially those involving reducing costs in their end-to-end processes and gaining competitive advantage by employing IT.

1.7 Limitations of the Study

The data collection process was tedious and time consuming, this is because of the administration of the questionnaires and subsequent coding of the data into a statistical

software for analysis. To address this problem, the researcher engaged research assistance to collect the responses and code the data.

Flaws are present in any research undertaken, and this is not exceptional. The main challenge the study faced was the non-response of the questionnaires due to absence of some respondents from work or non-willingness of the respondents to fill up the questionnaires. Therefore, to solve this issue, the researcher liaised and sought permission from the departmental heads to access as much information as possible, necessary for the research topic.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

An assessment of the works on the relationship between information technology and lean production is covered in this chapter. Specifically, this chapter covers theoretical review, the information technology aspects and lean production.

2.2 Theoretical Review of Literature

It refers to a blueprint or guide for a research that consists of concepts, constructs theoretical principles and tenets of a theory (Grant & Onsanloo, 2014). It lays the basis upon which a research is conducted and guides researcher not to digress from the boundaries of established concepts to create his or her concluding educated and educational impact (Adom *et al.*, 2018). Lean production is a component of lean systems with underlying theories that enable organizations to influence its operations. According to Westbrook (1995) operations, management academics need to embrace the relationship between theory and practice in order to show its influence in the achievement of competitive advantage. The theories linked to IT and LP implementation in industrial firms includes; theory of constraints and knowledge-based view theory. These theories entail the relationship of the aspects of information communication and lean production.

2.2.1 Knowledge Based View

This theory proposed by Thompson and Walsham (2004) considers knowledge as a principle asset in an organization. It stipulates that knowledge in an organization can be found in different areas including records, papers, guidelines, standards, processes together witth untapped tacit skill and knowledge of each employees. Knowledge in an organization is used to improve service delivery. It can be demonstrated within and outside the organization in many forms and transferred from one person to another hence ensuring continuity and continuous improvement (Thompson & Walsham, 2004).

According to Madiavale (2016), knowledge management simplifies decision making by providing managers with the data needed to come up with better, more up to date high-quality resolutions that are beneficial to their organization. It also helps them put together a learning organization by making learning routine with continuous improvement through critical reviewing of tasks, identifying successes and failures and documenting them for future reference. Jayaram and Xu (2016) further alludes that knowledge management encourages a

change of culture that is open to managers sharing ideas and insight that could be sources of innovations. Through the implementation of knowledge based view theory, employee-training gaps can be identified. Managers in turn, use these gaps to come up with training programs specific to each employee's job and linked to the overall direction and key priorities of the company. This is in line with lean leadership that focuses on leadership development.

Knowledge based view is applicable in our research as it highlights the role of continuous learning in ensuring operational performance. By using LP, which can be augmented by IT, organizations use available knowledge to improve production processes. This will in turn translate to improving efficiency, cost reduction, effectiveness and reliability of services. In addition, the application of value stream mapping, total quality management and lean leadership requires knowledge and experience.

2.2.2 Theory of Constraints

Developed by Goldratt and Cox (2004), the theory of Constraints (TOC) involves recognizing constraints and coming up with ways to manage them with an aim to improve organizational performance. TOC is based on the principle organizations constantly face constraints that restrict the achievement of higher performance levels. This theory therefore focuses on identifying the most limiting factors that hinder an organization from achieving a set of objectives and then improving them until they are no longer limiting (Goldratt & Cox, 2004).

Jaideep, Hung, and Manu (1996) illustrated that to facilitate process improvements, the theory of constraints outlines concepts applicable to effectively identify key priorities in an organization, establish the constraints to achieving targeted performance on the performance indicators that directly link to the key priorities, and develop practical ways of cascading and measuring to facilitate process improvements and bring visibility on performance. Identification of constraints in banks can be done through three TOC set of measurements: throughput, operating expense and inventory. Unlike manufacturing where constraints would be found in capacity or equipment, constraints in service companies are commonly found in policies and procedures. The TOC can be effective where a well laid out standardized process is established which can clearly reveal problem areas common to employees in the organization (Jaideep, Hung & Manu, 1996).

In this study, the theory of constraints was used to show the connection between IT and LP utilization. The TOC involves identification of constraints in service delivery processes. These constraints mainly include; slow machines and movement from one office to another seeking approval and authorization, which can be overcome by introduction of IT. These constraints may negatively influence cost of delivery and lead-time for each customer. However, putting into practice lean management practices augmented by information technology would improve on material flow between workstations and hence reduce movement from one station to another during the production process.

2.3 Empirical Literature Review

This part assesses the empirical works that entails the impact of Information Technology process on Lean Production. The elements of IT covered in this section are; knowledge management, knowledge transfer, and knowledge use.

2.3.1 Internal IT integration and Lean Production

Internal IT integration is the sharing of information amongst internal functions, strategic cross-functional collaboration, and working in unison (Bharadwaj, 2000). Also according to Schlie and Goldhar (1995) and Small (1999), internal IT incorporation can be implemented to generate data together with facilitating sharing of information amongst organizations which can improve an organization's capabilities in terms of production. Attaran (1989) further established that intra-firm information systems allow industrialists to provide a wider range of produces by limiting setup time. This will enable minor batch runs that in end outcome leads to condensed lead periods. As per Co et al. (1998) implementing this system in a business reduces lead times. According to Schlie and Goldhar (1995), the changes that happened in U.S. manufacturing was as a consequence of computer-integrated manufacturing technology, comprising higher throughput speed together with client responsiveness competences.

Internal IT systems like for example advanced planning together with scheduling can aid in elimination of bottleneck and enable reduction cycle time. Lot size reduction together with quick changeover approaches can offer timely response to information systems like MRP and forecast demand-managing software, that could heighten that IT systems responsiveness resulting to reduced customer lead time (Bharadwaj, 2000).

Internal IT integration includes the progression and reconfiguration of IT to bolster industry systems. Internal IT integration is the use of IT tools in business operations strategy so as to bring a positive effect on performance (Kim et al. 2011). IT administration capabilities, IT work force ability together with IT Infrastructure adaptableness as the needed measurements of internal IT Integration, in comparable with the scientific groupings of physical, human, managerial viewpoints, created by Barney (1991).

2.3.2 External IT Integration and Lean Production

Exterior IT integration is the integrated control of functions together with procedures across dealing associates using computer systems. External IT integration can either be upstream or downstream. Upstream instances encompass distribution of production strategies together with costs with merchants, while downstream examples entail the numerous shared data and processes related with joint planning, foretelling together with replenishment as per Germain and Iyer (2006). Studies conducted by Frohlich (2002) together with Subramani (2004) found out that IT integration with dealers and clients leads to enhanced organization presentation. Tushman and Nadler (1978), on the other hand, fixated on methods for deal with conservational fears via information handling capabilities and established that inter-governmental information systems are an example of such mechanism. Information-enriched supply chain concept proposed by Mason-Jones and Towill (1999) isolates the lead-time in a supply chain into movement of material together with info movement lead time. Organizations are more linked internally plus externally in an information-enriched supply chain. This is as a result of information distribution causing reduced info lead-time plus reduced total lead time in a supply sequence.

Galbraith (1973) opines that external IT integration decreases the decision-making procedure leading to data integration essential for information to aid as a shared language for the dealings taking place in the firm. However, Huber (1982) retaliates that inadequate information integration leads to postponements, reductions in communication plus bigger misrepresentation of significance. External IT integration assists supply chain associates in attainment mutual choices by enabling data interchange, remembrance together with standardization. Cachon and Fisher (2000) established that external IT combination reduces lead-time, allocation of demand, together with inventory information could reduce the order processing lead-time. As per Lee et al. (2000) studied data sharing in a two-level supply

chain. The research findings established that sharing the present demand variation data tips to vital inventory decrease that is usually connected with lessened lead times.

As per Homer and Thompson (2001), research which was about utilization of e-commerce in improving lean practices. It entailed integrating 20 medium sized organization supply chain in the automotive industry in Europe. The study concluded that so as to realize successful execution, e-commerce systems ought to adjust and complement lean production. In addition, it was noted that the internet together with e-commerce obtain a role of facilitating when establishing lean practices. Bruun and Mefford (2004) likewise stated that e-commerce together with the internet perform a role of facilitation in designing lean practices.

2.3.3 Knowledge Management, IT Integration, and Lean Production

Knowledge management as per Sison (2006) involves creating, sharing, applying and handling the knowledge together with the data of a business. Additionally, Hicks et al. (2006) opine that that recognizing, capturing, recovering, sharing, and assessing an organization's information resources can be done via an integrated methodology that is aided by knowledge management sponsor. The information assets include; databases, strategies together with procedures and other information that is not documented, and employees cannot retain in their memories.

Long et al. (2005) stated that knowledge managing drastically cut costs and better the understanding regarding the office leads to safe together with less risky job surroundings. Management of knowledge at all times follows the principle of smart work. Smart work entails logical thinking and less physical plus mental struggle, consequently reducing the product life cycle time in the long run saving in time together with expenses. Choice making would be easy as knowledge managing offers essential information together with data pertaining to every section in the enterprise (Long et al., 2005).

Further, management of knowledge plays a critical part in strategic planning at the managerial level. It needs the precise information in designing together with executing policies to attain company aims. As per Sison (2006), knowledge management decreases worker training by giving the essential data to new workers and with professional's management by experts in their field of work area. In addition, management of knowledge makes the business resourceful and effective in terms of making policy, strategic planning,

harmonization amongst employees together with data sharing by facilitating the advanced technology and updated data (Hicks, Galup, & Dattero. 2006).

Business enterprises should expand the receptors that will soak up the external knowledge, this is synonymous to external IT integration. By utilizing benchmarking. firms can attain tacit and explicit knowledge from external sources. The firms internal tacit and explicit knowledge can be integrated with external knowledge sources and the emerging knowledge gap can be bridged by acquiring new knowledge (Messa & Testa, 2004). Ju, Li. and Lee (2006) opined that for organizations to achieve competitive advantage, they should incessantly learn from external sources. Over suitable knowledge sharing and distribution, business enterprises can enhance IT integration. Firms must develop channels through which employees can share knowledge. Plessis (2007) affirmed that integration depends on knowledge and firms should identify knowledge capabilities and capacities in order to augment IT integration.

Firms that swiftly capture and execute new knowledge across the enterprise have the ability to foster IT integration when contrasted with institutions that do not focus on this aspect. The key attribute of IT integration is to augment the capacity of firms to spot and capture its tacit knowledge. Externally the tacit knowledge can be attained by the organization from suppliers, bankers, customers among others. By attaining the tacit knowledge, it does perform an important role in development of the IT integration process. Tacit knowledge importance increases particularly in the sectors where there is scarcity in explicit knowledge (Cavusgil, Calantone & Zhoa, 2003).

Institution through proper management can be able to identify tacit knowledge that previous was not aware of. In addition, knowledge management helps enterprise in articulating tacit knowledge inform of explicit knowledge, which is a strong IT integration base (Plessis: 2007). Knowledge management integrates various sorts of explicit and tacit knowledge. Integration is able to enable determining of the sort of explicit and tacit knowledge existing in the institutions. Additionally, knowledge undertakings for example knowledge gathering, learning, sharing, reusing and retrieval perform a significant role in fostering IT integration (Ju, Li & Lee, 2006). By use of knowledge management activities, firms can establish the knowledge distance from outside and inside the institution. Enterprises manage this

knowledge, which is inform of databases. which ensures the right type of knowledge is available at the right time for the right person (Shankar et al., 2003).

2.3.4 Information Technology and Lean Production

In the global scene Kobus, Westner. and Strahringer (2016) conducted a study on lean managing of IT administrations, it was mainly a literature evaluation that laid out the research methodology and potential focus areas for further studies. The literature review established that lean IT could benefit IT organizations in three areas in which include; increased transparency, improved demand management. and increased skill management.

Bhaskar and Sayed (2009) carried out a study on the part of IT in lean enterprise systems. It was mainly a literature review on benefits of lean-IT in companies and how IT can be valuable in client service together with unceasing development by applying knowledge managing. The study established that; IT offers essential data for the clients pertaining to quality, new features together with product design of the new products. IT performs a major part in the safekeeping of information in the business. In addition, Information technology offers security to the clients pertaining delivery of product and details of the product. Lean management systems offer new ideas regarding the nonviable and needless undertakings in the business since lean diminishes waste and develop satisfaction of clients.

Moyano-Fuentes et al. (2012) did a study on influence of usage of IT on LP implementation with focus in the automotive sector. The degree of implementation of lean production was carried out in accord with the level of use plus the type of IT being implemented whether internal and external. The research findings exhibited that organizations require to supplement the level of usage of internal or intra-organizational IT so as to raise the degree of execution of LP hence improve efficacy. In addition. the findings showed that external or inter-organizational IT solely has a significant negative effect on the degree of lean production implementation when internal IT is measured. Control systems like JIT systems apply local information for control as per Pyke and Cohen (1990). Karmarkar (1989) found out that integrating MRP systems together with JIT systems could enhance the efficacy manufacturing system.

Locally, Wamalwa, Onkware and Musiega (2014) investigated on operational performance and established that manufacturing using lean production has a definite outcome on

manufacturing performance. Yala (2016) further investigated the lean supply chain management and established demand management, waste management, cross enterprise collaboration, cultural practices and standardization as the key lean tools implemented by manufacturing firms in Kenya. Ahlstrom (2004) analyzed the relevance of lean management practices in the service industry. The research indicated the tenets of lean practices that can be incorporated in the service industry to improve its performance.

Nonetheless, Ahlstrom (2004) indicated that without adequate allocation of resources and proper implementation the benefits cannot be realized. This empirical literature review shows that lean practices can be well executed in service organizations to improve performance. However, their application to the entire organization and effect on an organization's performance has not been clearly outlined. Mwachari (2018) carried out a research on lean production practices and operational presentation of Kenyan commercial banks. The study methodology employed descriptive statistics together with correlation analysis. The findings of the research exhibited that the three lean management practices; Value Stream Mapping (VSM), TQM, and lean leadership had a significant association with operational performance.

2.4 Research Gap

Table 2.1 gives a summary of preceding research whose variables are related with those under the current study. An insight into the methodologies adopted and findings allows the researcher to generate the knowledge gaps in regard of theoretical, contextual or procedural dimensions.

Table 2.1: Summary of Knowledge Gaps

Author	Study Title	Findings and Conclusions	Gaps	How current study will address the gaps
Kobus, Westner, and Strahringer (2016)	Lean management of IT organizations: A slack theory viewpoint of IT	Lean IT could benefit IT organizations in three areas in which include; increased transparency, improved demand management, and increased skill management.	The study did not highlight the effect of IT integration on lean production implementation, this presents a knowledge gap. The study was not conducted in Kenya and this presents a contextual gap. The study was mainly a literature review that laid out the research methodology and potential focus areas for further studies, thus this presents a methodological gap.	The current study examined the impact of IT integration on lean production implementation. The current study was conducted in Kenya, a case study of Nestle Kenya. The current study employed inferential statistics to determine a cause-effect relationship between IT and lean implementation.
Bhaskar and Sayed (2009)	Role of IT in lean enterprise systems	IT offers essential data for the clients pertaining to quality, new features together with product design of the new products. IT performs a significant part in the safe keeping of information in the business. In addition, Information technology offers security to the clients pertaining delivery of products and details of product details. Lean management systems offer new ideas regarding the no	The study did not highlight the effect of IT integration on lean production implementation, this presents a knowledge gap. The study was not conducted in Kenya and this presents a contextual gap. The study was mainly a literature review on benefits of lean-IT in businesses and how it can be beneficial in client service and constant enhancing by using knowledge administration. This presented a	The current study examined the impact of IT integration on lean production implementation. The current study was conducted in Kenya, a case study of Nestle Kenya. The current study employed inferential statistics to determine a cause-effect relationship between IT and lean implementation.

		value and needless undertakings in the business since lean reduces the wastage and develops client satisfaction.	methodological gap.	
Moyano-Fuentes et al. (2012)	Influence of use of IT on LP adoption: Study on automotive industries	The research findings exhibited that organizations require to supplement the level of usage of internal or intra-organizational IT so as to raise the degree of execution of lean production hence improve efficacy. In addition, the findings showed that external or inter-organizational IT solely has a significant negative effect on the degree of lean production implementation when internal IT is measured.	The study did not highlight the effect of IT integration on lean production implementation, this presents a knowledge gap. The study was not conducted in Kenya and this presents a contextual gap. There is a contextual gap in the study because it focused on the automotive industry.	The current study analyzed the effect integration on lean production implementation. The current study shall be done in Kenya, a case study of Nestle Kenya. The current study dealt with the Fast-Moving Consumer Goods (FMCG) sector.
Wamalwa, Onkware and Musiega (2014)	Effect of lean manufacturing technology strategy implementation on factory time efficiency: A case study of Mumias sugar company limited in Kakamega County, Kenya	Lean manufacturing has a definite outcome on manufacturing performance.	The study focussed on the effect of lean production on organizational performance, it did not highlight the impact of IT on lean production implementation. This presents a knowledge gap.	The current study analyzed the impact of IT on lean production implementation.
Yala (2016)	Lean management supply chain and operational performance of manufacturing firms in Kenya	Demand management, waste management, cross enterprise collaboration, cultural practices and standardization as the key lean tools implemented by manufacturing firms in	The study centered on the tools of lean management, it did not highlight the effect of IT on lean production implementation. This presents a knowledge gap.	The current study analyzed the impact of IT on lean production implementation.

		Kenya.		
Ahlstrom (2004)	Lean service operations: translating lean production principles to service operations	Tenets of lean practices that can be incorporated in the service industry to improve its performance. Further findings were that without adequate allocation of resources and proper implementation the benefits cannot be realized. This empirical literature review shows that lean practices can be well executed in service organizations to improve performance. However, their application to the entire organization and effect on an organization's performance has not been clearly outlined.	The study concentrated on the effect of lean production on organizational performance, while incorporating the moderating variables; adequate allocation of resources and proper implementation. It did not highlight the effect of IT on lean production implementation. This presents a knowledge gap. The study was an empirical literature review, therefore presenting a methodological gap.	The current study analyzed the effect of IT on lean production implementation. The current study employed inferential statistics to determine a cause-effect relationship between IT and lean implementation.
Mwachari (2018)	Lean management practices and operational performance of commercial banks in Kenya	The three lean management practices: VSM, TQM and lean leadership have a noteworthy association with operational presentation.	The study concentrated on the effect of lean production on administrative presentation, it did not highlight the effect of IT on lean production implementation. This presents a knowledge gap.	The current study analyzed the impact of IT on lean production implementation.

2.5 Conceptual Framework

Rocco and Plakhotnik (2009), stipulates that a conceptual framework lays the foundation for research objectives and questions by grounding a study in the right knowledge constructs. The independent variables in this study are the elements of IT that constitute; knowledge management, internal IT integration, and external IT integration, whereas the dependent variable is lean production implementation.

IT is hypothesized to raise the degree of lean production application and hence improve efficacy of an organization (Moyano-Fuentes et al., 2012). Knowledge management is expected to drastically cut costs because of improved information pertaining the office, which will translate to safe together with a less risky work environs. It is involved with logical reasoning plus a lesser amount of physical and mental work, therefore reducing the cycle of product life eventually making savings in time and expenses. Knowledge management would make decision making stress-free because it offers essential data and facts pertaining every division in the enterprise (Long et al., 2005).

IT links individuals and enterprises with indirect information transferal via internet together with databases. IT makes it easy for transformation of knowledge to all employees in all levels of the organization with stress-free right of entry to the business web sites and database to evaluation preceding case readings plus developments. By giving the e-mail amenities and intranet within the organization, there is a specialized association amongst the employees and improved understanding together with data distribution regarding the current and forthcoming projects (Long et al., 2005).

Knowledge could be implemented efficiently by IT through technology for example Artificial Intelligence (AI) to assist in production (Sison, 2006). Knowledge use enables novel information and knowledge without offering any teaching for workers. Problems for example can be resolved by using technology like AI that establishes the answers by its own. Knowledge use enables the management of issues fast minus any human support (Pollock, 2002).

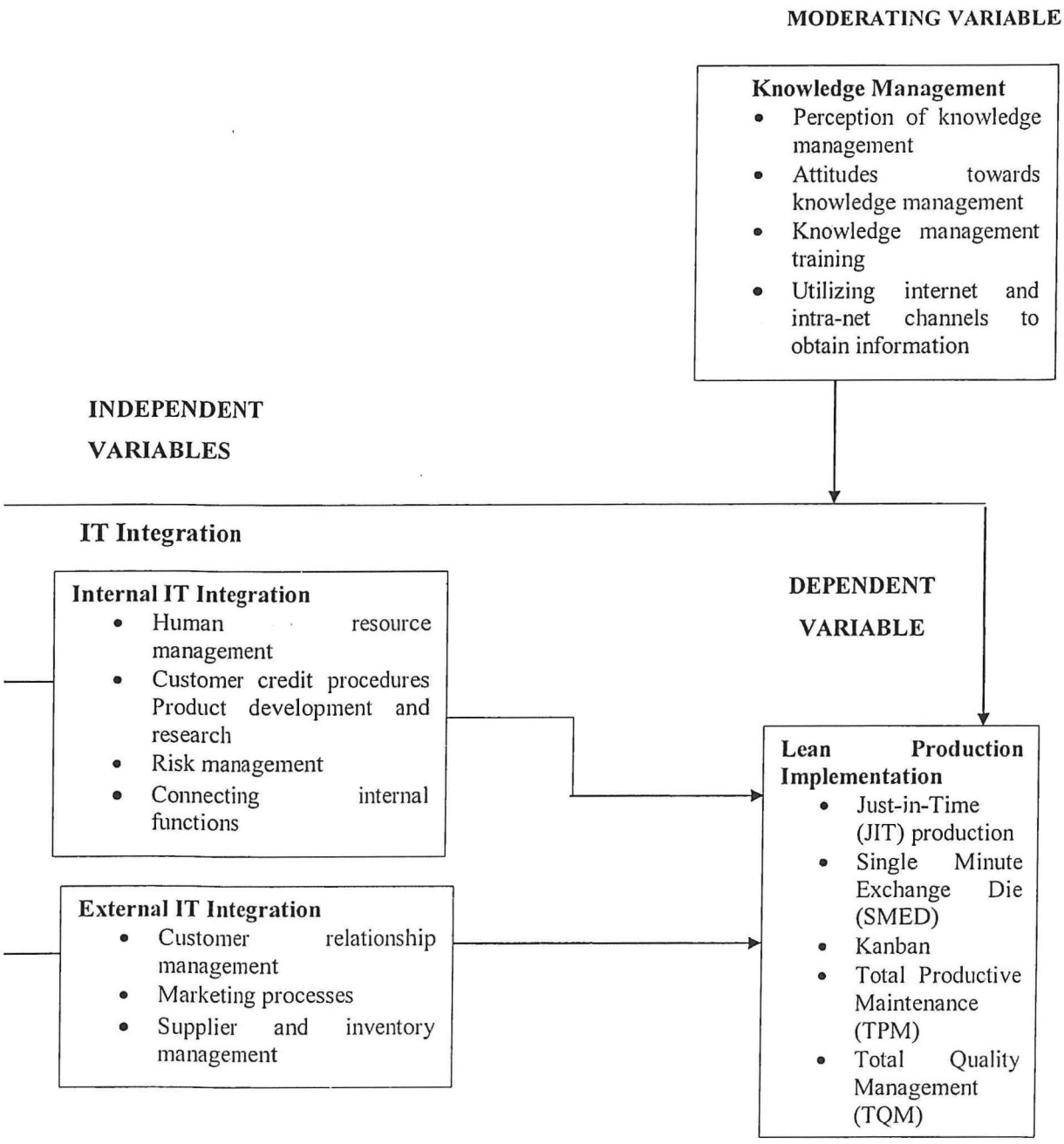


Figure 2.1: Conceptual Framework

The resultant research hypotheses were formulated, which steered the study. **H11:** There is a significant association between management competency quality dimension and performance of family planning program in Nakuru county

i. **$H1_A$**: There is a significant effect of internal Information Technology (IT) integration on lean production in Nestle' Kenya.

ii. $H2_A$: There is a significant effect of external Information Technology (IT) integration on lean production in Nestle' Kenya.

iii. $H3_A$: There is a significant moderating effect of knowledge management on the relationship between both internal and external IT integration and lean production in Nestle' Kenya.

2.6 Operationalization of Study Variables

This section discussed how the research variables were operationalized. The dependent variable will be lean production implementation. The independent variables are; internal IT integration, and external IT integration. The study assessed how knowledge management impacts on both external and internal IT integration. This is displayed in Table 2.2.

Table 2.2: Operationalization of Study Variables

Variable	Nature of Variable	Operational indicators	Measurement scale	Measurement and analysis
Lean production implementation	Dependent Variable	JIT production, Single Minute Exchange Die (SMED), Kanban, Total Productive Maintenance (TPM), and TQM.	Likert-type scale (Ordinal Scale)	Descriptive, inferential analysis
Internal IT integration	Independent Variable	Human resource management, customer credit procedures, product development and research, risk management, and connecting internal functions.	Likert-type scale (Ordinal Scale)	Descriptive, Inferential analysis
External IT integration	Independent Variable	Customer relationship management, marketing processes, and supplier and inventory management.	Likert-type scale (Ordinal Scale)	Descriptive, Inferential analysis
Knowledge management	Moderating Variable	Perception of knowledge management, attitudes towards knowledge management, knowledge management training, and utilizes internet and intra-net channels to obtain information.	Likert-type scale (Ordinal Scale)	Descriptive, inferential analysis

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The section describes study methods implemented to establish the research objectives and stages followed to conclude the research. Further, it defines the study design, the target populace, data gathering methods, and data analysis used to produce anticipated information of the study.

3.2 Research Philosophy

This study viewpoint employed was positivistic paradigm. Positivism provides theoretical description and provides valid fact data that is "scientific". Theories provide framework established on descriptions and justifications. Levin (1988) notes that positivists have faith in reality being steady and defined from perspective without meddling studied phenomena. In addition, the phenomena studied should be isolated and observations made credible. Often it entails alteration of actuality with variants in independent adjustable to recognize uniformities form associations amongst essential factors of social biosphere. Forecasts are made based on formerly described realities and their inter-relationships. This current research was established on systematic method and cause and effect association. It will analyze the impact of IT integration on lean production. The study applied positivist research philosophy because it was guided by relevant theories and empirical literature.

3.3 Research Design

The research applied an exploratory, ex post facto and causal study design. The time frame was cross-sectional with the scope being a case study. It was a field setting with the unit of analysis being the firm. The research design was preferred because it allows describing population through uniform information from a sizeable populace at a point in time. The method was used because it addresses the aim of research in examining the association amongst variables of the research. The design takes into account aspects like sample size relative to target populace, the variables used in the research and data gathering methods.

3.4 Population

A populace is a set of things or entities with shared observable characteristics (Mugenda & Mugenda, 2013). All the employees of Nestle Kenya, numbering 70, formed the population. No sample was derived for the study because gathering data from the population was not affected by time and financial constraints. Thus, the study was a census.

3.5 Data Collection

According to Kothari (2004), a questionnaire that is self- administered is a systematic approach of eliciting values, beliefs, attitudes and opinion of the people. To collect data, the researcher formulated a questionnaire, which is indicated in Appendix I. The type of data collected was primary data and quantitative. Thus, data on knowledge management, internal IT integration, external IT integration, as well as lean production was collected from the respondents who formed the population. The respondents' perception of the attributes on the above factors and were gauged.

The data collection was done by means of a questionnaire utilizing likert scale as shown in Appendix I. The researcher personally gave out the questionnaires to the respondents and the questionnaire consisted of close-ended queries only. Close-ended questions gathered structured replies to permit for the commendations that were more concrete. The ranking of the attributes was tested using the close-ended questions. These questions aided in the lessening of similar answers consequently resulting in diverse replies that was acquired. The examiner of the study personally overseen by the study to ensure that the respective respondents received all the questionnaires. Precaution and control was attained by keeping a record of all the questions asked and their responses.

3.6 Data Analysis

Information was validated, coded, and checked for mistakes and oversights. The data was organized, tabulated and simplified to make it easier to analyze, interpret and understand. Statistical Packages for Social Sciences (SPSS) version 25 will aid in analyzing the data. Descriptive investigation of data applied measures of central tendencies and standard deviations. Further, the associations between the study variables and testing of the hypothesis were executed using inferential statistics, which will include correlation analysis and linear regression.

Correlation analysis was used to show whether and how strongly the elements of IT integration are associated with lean production implementation. The goodness of fit among the different models was established using the coefficient of determination (R^2). Since the study consists of different independent, moderating, and dependent variables, the study employed different regression analysis models. The simple linear regression analysis was applied in testing the effect of internal and external IT integration on lean production while

the hierarchical multiple linear regression analysis was applied to test the role of knowledge management on the association amongst IT integration and lean production. The level of significance was 0.05 and the study will be conducted at the 95% confidence interval.

The summary of conceptual relationships derived from literature review, analytical statistical models and interpretation of results are presented in Table 3.1. According to the summary presented in Table 3.1, a simple regression model tested the direct link between both external and internal IT integration and lean production in Nestle Kenya. The moderating impact of knowledge management on the association amongst IT integration and lean production in Nestle Kenya was analyzed by utilizing hierarchical multiple linear regression analysis.

3.6.2 Diagnostic Tests

Diagnostic tests on normality, linearity, multicollinearity, and autocorrelation were conducted on the collected data to establish its suitability in the formulation of linear regression model. Normality was tested by Shapiro wilk, which though common, fails to work well where large amount of data is involved, and it was supplemented by the Kolmogorov-Smirnov test which is suitable for testing distributions of Gaussian nature which have specific mean and variance. Linearity indicates direct proportionate association amongst dependent and independent variable such that change in independent variable is followed by correspondent change in dependent variable (Gall et al. 2006). Linearity was tested by the means of considering the normality and the homoscedacity of the individual variables. Homoscedacity tests were carried out by means of scatter plot diagrams.

Tests for multicolinearity of data were carried out using Variance Inflation Factors (VIF) plus tolerance statistics to determine if independent variables considered in this study is significantly correlated with each other. According to Grewal *et al.*, (2004) the main sources of multicolliearity are small sample sizes, low explained variable and low measure reliability in the independent variables. Auto-correlation test was carried out through the Durbin-Watson Statistic.

Table 3.1: **Analytical Statistical Models, and Interpretation of Results**

Objective	Analytical techniques	Interpretation
Objective One: To investigate the effect of internal Information Technology (IT) integration on lean production in Nestle' Kenya.	Simple Linear Regression Analysis $Y_{it} = \alpha + \beta_1 X_{it} + \varepsilon_{it}$ Y_1= Lean Production α= constant (intercept), β_1 = regression coefficients X_{it}= Internal IT Integration E_{it} = Error term	R^2 assessing the variations in dependent variable that are as result of the association with the independent variable. F test (Analysis of Variance) assessing the overall strength and significance of the simple regression model t- test in determining the individual significance of the relationship
Objective Two: To analyze the effect of external Information Technology (IT) integration on lean production in Nestle' Kenya.	Simple Linear Regression Analysis $Y_{it} = \alpha + \beta_1 X_{it} + \varepsilon_{it}$ Y_1= Lean Production α= constant (intercept), β_1 = regression coefficients X_{it}= External IT Integration E_{it} = Error term	R^2 assessing the variations in dependent variable that are as result of the association with the independent variable. F test (Analysis of Variance) assessing the overall strength and significance of the simple regression model t- test in determining the individual significance of the relationship
Objective Three: To review role of knowledge management on the relationship between Information Technology (IT) integration and lean production in Nestle' Kenya.	Hierarchical Linear Regression Analysis $Y_{it} = \beta_1 X_{1it} + \beta_2 X_{1it} * M + \alpha_i + \mu_{it} + \varepsilon_{it}$ $Y_{it} = \beta_1 X_{1it} + \beta_2 X_{2it} * Z + \alpha_i + \mu_{it} + \varepsilon_{it}$ Y_{it}= Lean Production α_i = (i=1....n) is the unknown intercept for each entity (n entity-specific intercepts). i = entity t = time. X_{1it} = Internal IT Integration/ External IT Integration X_{2it} = Knowledge Management M,Z = Moderating Effect of Knowledge Management β_1, β_2 = Regression coefficients u_{it} = Between entity error term ε_{it} = is within entity error	R^2 shows the suitability of the model and additionally the variation in dependent variable. Beta (β) in determining how each predictor variable contributed to the model significance. F-ratio, P-value and t-statistic exhibits the model constructs significance. A notable variation in Adjusted R^2 when an interaction term is introduced (X*Z) recognizes a moderating effect of the term.

3.7 Research Quality

The section entails the measures of validity and reliability addressed in the study.

3.7.1 Validity

Instrument validity is the capacity that an instrument has so as to measure the constructs as purported. In this study, questionnaires were outlined borrowing from related prior studies with changes geared towards addressing study objectives. The research supervisor double-checked the document to ensure that the theoretical aspects were arrived at as intended. The researcher also incorporated recommendations and corrections from the supervisor, academic staff, as well as from the respondents who participated in the pilot test in ensuring validity of the research instrument. The researcher also performed the KMO and Bartlett's tests of the variables emanating from the responses of the participants of the pilot test to ensure criterion validity.

To avoid bias, respondents did not indicate their names in the questionnaire. The researcher personally administered the questionnaire and did not engage research assistants who might introduce bias through either tonal variation or gestures. Additionally, the wordings of the questionnaire were selected appropriately. The questions in the questionnaire did not steer particular responses, or make the respondents understand the situation in a certain way.

3.7.2 Reliability

Reliability shows the degree at which outcomes are error free or extent at which an instrument of research yields results that are consistent (Cooper & Schindler, 2014). The Cronbach alpha analysis aided to ascertain the research instruments' reliability by showing data collection instrument internal consistency. The Cronbach's Alpha depicts reliability by showing a true 'base' score. Cronbach's Alpha is crucial to a scholar in ensuring consistency and reliability of the questionnaire even if the questions are interchanged with related ones (Valencia-GO, 2015). Cronbach's Alpha is based on the formula indicated below.

$$\alpha = rk / (I + (K-I)\, r)$$

Where;

k is the total number of variables.

r is the mean of the inter-item correlation.

Table 3.2 illustrates the rule of thumb which is applicable in most conditions. Usually, a range of 0.7 is regarded acceptable whereas a range above 0.8 is good.

Table 3.2: Chronbach's Rule on Internal Consistency

Chronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source: (Sekaran, 2003)

A pilot study is a preliminary small study performed in a trial to predict and improve upon the study design before performance of the actual research with a focus on evaluating cost, feasibility time, effect size and adverse events (Cooper & Schindler, 2014). The researcher selected four respondents for the pilot test who were employees of Nestle Kenya. The four participants were picked from varying departments. The pilot study participants did not participate in the final data collection. During the pilot test, the research instruments clarity was assessed and collected data was analyzed and reliability tested. The pilot study results were key in improving and strengthening data collection instrument.

3.8 Ethical Issues in Research

Confidentiality and privacy were observed by keeping all the information gathered confidential and strictly using it for the purpose of research. The participants were informed that the information is for academic research findings and no undesirable person is to access the questionnaire. The research abstained from inquiring humiliating questions or conveying disgust or shock, not using statements that are threatening or persuasive response along certain lines, and not causing fear or anxiety during data collection.

The reason for undertaking the research was unveiled on factual truths. Respondents' requests for anonymity were adhered to. The identity of the respondents was concealed and

kept confidential as their names were not be indicated in the questionnaires. The subjects were requested to participate in the research voluntarily through a research introduction letter and informed consent sought through filling the information consent form. The findings were disseminated based on true findings, free of any bias. Ethical clearance was obtained from the Strathmore University Ethical Review Committee and research permit acquired from the National Commission for Science, Technology and Innovations (NACOSTI).

3.9 Pilot Study Results

This section displays the results obtained from the pilot study conducted for the current research.

3.9.1 Pilot Test Process

Data regarding the impact of IT integration on lean production implementation at Nestle Kenya was collected. Pilot testing was done in testing the reliability and validity of the instrument prior to the actual study. The respondents identified for the pilot study were not be recruited into the main study to circumvent bias. The instrument was pilot tested on 5 respondents drawn from the target population and who were equivalent to sample size of 10%. After the pilot test, the questionnaire was edited for completeness and consistency. Five questionnaires were issued to the respondents and all of them were filled up and returned representing 100% response rate. This is indicated in Table 3.2.

Table 3.3: Pilot Study Response Rate

Response	Frequency	Percentage
Returned	5	100%
Unreturned	0	0%
Total	5	100%

3.9.2 Validity

Richardson (1999) considers validity as a level to which test scores relate to a criterion outside the test. Kothari (2003) observes that the degree to which a research instrument measures at item to precision is validity, which is a measure of accurate representation of the obtained data to the theoretical concept. Expert judgment by the supervisor and Kaiser-Meyer-Olkin (KMO) test was performed to test for validity. KMO sampling adequacy measure is interpreted as follows: less than 0.5 is unacceptable, 0.5's is miserable, 0.6's is mediocre, 0.7's is middling while 0.8's is meritorious and finally 0.9 and above is marvelous.

The minimum requirement for the study is 0.5. Bartlets test of sphericity must be significant at ≤ 0.05.

Table 3.4 presents the validity findings for the variable internal IT internalization utilizing the KMO and Bartlett's tests.

Table 3.4: Validity for Internal IT Integration

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.712
Bartlett's Test of Sphericity	Approx. Chi-Square	61.758
	Df	11
	Sig.	0.010

The KMO value was 0.712, which indicated that the variable internal IT integration was valid since the value was above 0.5. The Bartlett's significance level was 0.010 which was less than 0.05 further supporting the validity findings.

Table 3.5 presents the validity findings for the variable external IT internalization utilizing the KMO and Bartlett's tests.

Table 3.5: Validity for External IT Integration

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.635
Bartlett's Test of Sphericity	Approx. Chi-Square	40.925
	Df	15
	Sig.	0.000

The KMO value for the variable external IT integration was 0.635, which implied that it was valid as further supported by a Bartlett's value of 0.000.

Table 3.6 presents the validity findings for the variable knowledge management utilizing the KMO and Bartlett's tests.

Table 3.6: Validity for Knowledge Management

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.601
Bartlett's Test of Sphericity	Approx. Chi-Square	33.79
	Df	11
	Sig.	0.004

The KMO value for knowledge management was 0.601 which greater than 0.5 indicating it is valid and was also supported by a Bartletts significance value of 0.004 which is less than 0.05.

Table 3.7 presents the validity findings for the variable lean production implementation utilizing the KMO and Bartlett's tests.

Table 3.7: Validity for Lean Production Implementation

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.672
Bartlett's Test of Sphericity	Approx. Chi-Square	81.143
	Df	9
	Sig.	0.000

The variable lean production implementation had a KMO of 0.672 which implies validity and a Bartlett's value of 0.000 which further supports the findings.

3.9.6 Reliability

Reliability is the consistency or stability of scores over time or across raters (Golafshani, 2003). The research instrument is considered reliable if the same study results can be obtained using similar methodology. Cronbach's alpha $\propto$ assessed the reliability coefficient of the research instrument as all items in the questionnaire used a Likert type scale as the measurement scale. Cronbach (1951) described coefficient alpha as a test representing questionnaire reliability estimate. Serkan (2003) notes that Cronbach's alpha values range between 0.7 and 0.9, with 0.8 as the most preferred, while those below 0.7 indicates low internal consistency. Table 3.8 presents the summary reliability of the study.

Table 3.8: Summary Reliability Table

Variables	Cronbach's Alpha	Critical Value	Conclusion
Internal IT Integration	0.715	0.7	Reliable
External IT Integration	0.712	0.7	Reliable
Lean Production Implementation	0.718	0.7	Reliable
Knowledge Management	0.794	0.7	Reliable

Table 3.9 presents the reliability results for the variable internal IT integration utilizing the chronbach's alpha of internal consistency test.

Table 3.9: Reliability Statistics for Internal IT Integration

Reliability Statistics	
Cronbach's Alpha	**N of Items**
0.715	5

The cronbach's alpha is 0.715 which indicates that the variable internal IT integration is reliable.

Table 3.10 presents the reliability results for the variable external IT integration utilizing the chronbach's alpha of internal consistency test.

Table 3.10: Reliability Statistics for External IT Integration

Reliability Statistics	
Cronbach's Alpha	**N of Items**
0.712	5

A cronbach's value of 0.712 indicates that the variable external IT integration is reliable.

Table 3.11 presents the reliability results for the variable knowledge management utilizing the chronbach's alpha of internal consistency test.

Table 3.11: Reliability Statistics for Knowledge Management

Cronbach's Alpha	N of Items
0.794	5

The Cronbach's alpha value for the variable knowledge management was 0.794, which is above 0.7 indicating the variable is reliable.

Table 3.12 presents the reliability results for the variable lean production implementation utilizing the chronbach's alpha of internal consistency test.

Table 3.12: Reliability Statistics for Lean Production Implementation

Reliability Statistics	
Cronbach's Alpha	**N of Items**
0.718	5

Further, the variable lean production implementation has a cronbach's alpha of 0.718 indicating that it is reliable.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND INTERPRETATION

4.1 Introduction

This section entails the data examination, interpretation and the deliberations of the outcomes. The section hence is fragmented to five sub sections, which entail; the origin of study, the target response rate variables, the comprehensive respondents' characteristics, descriptive statistics, inferential statistics, and interpretation and the arguments regarding the outcomes. Precisely this chapter summarizes the platform for data presentations, analysis, and interpretations.

4.2 Response Rate

In survey research, a response rate is the number of responses obtained divided by the number of target respondents. The response rate is also denoted as the completion rate or return rate and it is usually expressed percentage form. Information on the rate of response for this research is displayed in Table 4.1.

Table 4.1: Study Response Rate

Response	Frequency	Percentage
Returned	55	78.57%
Unreturned	15	21.43%
Total	70	100%

Table 4.1 showcases that seventy questionnaires were issued to the entire staff of Nestle Kenya. The study findings exhibit that out of the 70-total number of issued questionnaires to the target respondents, only 55 responses were made with adequate information and returned which translated to an overall 78.57% study response rate. This is in line with Mugenda and Mugenda (2010), who stated a study with 70% response rate and above have a sufficiency for analysis and a conclusion can be drawn from it.

4.3 Background and Respondent Characteristics

The research set out to determine the background and respondent characteristics of all the 70 respondents enlisted for the study who were employees at Nestle Kenya. Highlighted are the background and respondent characteristics derived from the Part A of this study's questionnaire, which included; department, gender, age, education level, employment terms, and work experience.

4.3.1 Job Position

The target respondents were tasked to state their respective management levels. This was to determine if management level has any bearing on the perception of IT attributes and lean production implementation. In Table 4.2 , the findings are dispalyed.

Table 4.2: Job Position

		Frequency	Percentage
Valid	Top level management	3	5.6
	Middle level Management	33	61.1
	Junior staff	18	33.3
	Total	54	100.0
Missing	System	1	
Total		55	

Table 4.2 displays the respondents in various management levels. The highest proportion of the respondents, that constitutes 61.7%, were in the middle management level. Junior staff comprised of 33.3% while top-level management employees constituted 5.6% of the total employees. The uneven spread in the number of respondents in the various departments is not an indication bias since top-level management staff proportions is less in all companies and manufacturing firms have a huge proportion of middle level employees because most of the technical staff are casuals.

4.3.2 Department

Target respondents were tasked to identify the specific departments they served. This was to determine if the department has any bearing on the perception of IT attributes and lean production implementation. Table 4.3 displays the outcome.

Table 4.3: Department Worked In

		Frequency	Percentage
Valid	Supply Chain	9	16.7
	Finance	8	14.8
	Manufacturing/Operations	16	29.6
	Commercial	16	29.6
	Any other	5	9.3
	Total	54	100.0
Missing	System	1	
Total		55	

Table 4.3 indicates the specific division the respondents served. The highest proportion of the respondents that constitutes 29.6% each worked in the manufacturing/operations and commercial departments. Respondents that worked in the supply chain department constituted 16.7%. 14.8% of the respondents worked in the finance department while the least proportion of the respondents that constituted 9.3% worked in other departments. The uneven spread in the number of respondents in the various departments is not an indication bias since manufacturing firms have a huge proportion of employees in manufacturing and commercial services.

4.3.3 Gender

The target respondents were requested to specify their gender. This was to determine if gender has any bearing on the perception of the IT attributes and lean production implementation. Shown in Table 4.4 are the findings.

Table 4.4: Gender

		Frequency	Percentage
Valid	Male	25	46.3
	Female	29	53.7
	Total	54	100.0
Missing	System	1	
Total		55	

The study established in Table 4.4 that 46.3 percent of those surveyed were males while 56.3 percent were females. The even spread in the number of respondents in accordance to gender is an indication of lack of bias.

4.3.4 Age

It asked the target respondent to define their age. This was to determine if age has any connection with the perception on the IT attributes and lean production implementation. The results are shown in Table 4.5.

Table 4.5: Age

		Frequency	Percentage
Valid	20- 29	6	10.9
	30– 39	32	58.2
	40 – 49	15	27.3
	50 and above	2	3.6
	Total	55	100.0

Table 4.5 exhibits that the highest proportion of the respondents that constitutes 58.2% are of the ages between 30 - 39. Respondents whose ages range from 40 to 49 constituted 27.3%, proportion of those aged between 20-29 was 10.9%, while the least proportion of the respondents that constituted 3.6% were aged 50 years and more.

4.3.5 Education Level

The participants were required to indicate their level of education. This was to determine if education level has any bearing on the perception of IT attributes and lean production implementation. The findings are displayed in Table 4.6.

Table 4.6: Education Level

		Frequency	Percentage
Valid	Secondary	1	1.8
	Diploma	4	7.3
	Bachelor's degree	34	61.8
	Postgraduate	16	29.1
	Total	55	100.0

Table 4.6 demonstrates the various educational qualifications of the study participants. The highest proportion of the respondents that constitutes 61.8% had attained a bachelor's degree. Respondents that had postgraduate qualifications constituted 29.1%, the proportion that attained diploma qualifications was 7.3%, while the least proportion of the respondents that constituted 1.8% had attained secondary qualifications.

4.3.6 Employment Terms

The target respondents were requested to specify their employment terms. This was to determine if employment terms have any bearing on the perception of IT attributes and lean production implementation. The study results are displayed in Table 4.7.

Table 4.7: Employment Terms

		Frequency	Percentage
Valid	Permanent	48	87.3
	Contract	7	12.7
	Total	55	100.0

The study established in Table 4.7 that 87.3% of respondents were employed on permanent basis whereas 12.7% were employed on contract terms. The findings indicate that Nestle Kenya mainly hires their employees on permanent basis.

4.3.7 Work Experience

The target respondents were implored to specify their work experience with Nestle Kenya. This was to determine if duration of working under one employer has any bearing on the perception of IT attributes and lean production implementation. The findings are displayed in Table 4.8.

Table 4.8: Work Experience

		Frequency	Percentage
Valid	5 and below	27	49.1
	6 – 10	14	25.5
	11 – 15	8	14.5
	16 – 20	4	7.3
	21 and above	2	3.6

	Total	55	100.0

Table 4.8 shows the various years the respondents had worked for Nestle Kenya. The highest proportion of the respondents that constitutes 49.1% had worked for Nestle Kenya for five years and below. The proportion of respondents who had worked for Nestle Kenya for 6 to 10 years was 25.5% and those who worked for periods ranging from 11 to 15 and 16 to 20 years constituted 14.5% and 7.3% respectively. The least proportion of the respondents that constituted 3.6% had worked for Nestle Kenya for 21 years and above. The uneven spread of work experiences maybe an indication of bias although the respondents were randomly distributed. Employees who have worked longer for one employer have are more likely to have more information and knowledge on IT aspects and lean production implementation as they are more likely to be engaged in decision-making roles.

4.4 Variables Descriptive Statistics

The study settled on descriptive cross-sectional research design since it allows findings generalization, analysis and variables relation. Among the variables used were internal IT integration, and external IT integration, which were the predictor variables, knowledge management that was a moderating variable, whereas lean production implementation was the dependent variable.

4.4.1 Internal IT Integration

The respondents were requested to rate the attributes of internal IT integration present in Nestle Kenya. An ordinal measurement scale was utilized to measure the variable through a five-point assorted scale to measure the respondent's perception towards internal IT integration in Nestle Kenya. Consequently, internal IT integration statistics were derived, and the outcomes exhibited in Table 4.9.

Table 4.9: Internal IT Integration Descriptive Statistics

	N	Mean	Std. Deviation
Nestle engages IT in human resource management	55	4.4364	.56972
Nestle engages IT in customer credit procedures	54	4.1481	.93984
Nestle engages IT in product development and research	55	4.0545	1.02593
Nestle engages IT in risk management	54	4.2963	.83845
Nestle utilizes ERP systems	55	4.9091	.29013
Average		4.3689	.73281
Valid N (listwise)	54		

It is depicted from the above results in Table 4.10 that 4.9091 is the highest mean of the attribute "Nestle utilizes ERP systems", which exhibits a 0.29013 standard deviation. The lowest mean is of the attribute "Nestle engages IT in product development and research", with a mean of 4.0545 and a standard deviation of 1.02593. The attribute "Nestle engages IT in human resource management" has an average of 4.4364 and a 0.56972 as standard deviation. The attribute "Nestle engages IT in risk management" has a 4.2963 as mean and a standard deviation of 0.83845. Finally, the attribute "Nestle engages IT in customer credit procedures" has a 4.1481mean and a 0.93984 standard deviation. The overall attributes had an average mean of 4.3689 and a standard deviation of 0.7328112205. This gives an implication that Nestle Kenya exhibits to a very high internal IT integration as one of the aspects of IT.

4.4.3 External IT Integration

The respondents were requested to rate the attributes of external IT integration present in Nestle Kenya. An ordinal measurement scale was utilized to measure the variable through a five-point Likert scale in measuring the respondents' perception towards external IT integration in Nestle Kenya. Consequently, external IT integration statistics were derived, and the outcomes exhibited in Table 4.10.

Table 4.10: External IT Integration Descriptive Statistics

	N	Mean	Std. Deviation
Nestle engages IT in customer relationship management	54	3.8148	.87035
Nestle engages IT in marketing processes	55	3.7273	.87039
Nestle lead-time in a supply chain is divided into electronic ordering information lead-time and physical material movement lead-time.	54	4.2593	.73164
Nestle shares demand and inventory data with suppliers/distributers to reduce the order processing lead time	53	3.9245	.93745
Nestle utilizes IT systems in the procurement process to select the most appropriate supplier	55	3.6727	1.01934
Average		3.8797	.88583
Valid N (listwise)	53		

The results of the study in Table 4.11 display that the highest aggregate of 4.2593 is of the attribute "Nestle lead-time in a supply chain is divided into electronic ordering information lead-time and physical material movement lead-time", which exhibits a standard deviation of 0.73164. The lowest average of 3.6727 is of the attribute "Nestle utilizes IT systems in the procurement process to select the most appropriate supplier", which have 1.01934 as standard deviation. The attribute "Nestle shares demand and inventory data with suppliers/distributors to shorten the order processing lead time" has average of 3.9245 and standard deviation of 0.93745. The attribute "Nestle engages IT in customer relationship management" has an aggregate of 3.8148 and 0.87035 standard deviation. Finally, the attribute "Nestle engages IT in marketing processes" has an average of 3.7273 and a 0.87039 standard deviation. The overall attributes had an average mean of 3.8797 with a standard deviation of 0.88583. This gives an implication that most of the commercial banks exhibited to a very high extent recognition as one of the intrinsic factors. This gives an indication that Nestle Kenya exhibits to a high extent IT integration as one of the aspects of IT.

4.4.1 Knowledge Management

The respondents were requested to rate the attributes of knowledge management in Nestle Kenya. An ordinal measurement scale was utilized to measure the variable through a scale of five points to measure the respondents' perception towards knowledge management in Nestle Kenya. Consequently, knowledge management descriptive statistics were derived and the outcomes exhibited in Table 4.11.

Table 4.11: Knowledge Management Descriptive Statistics

	N	Mean	Std. Deviation
I consider Nestle Kenya as a knowledge-based firm, it efficiently handles information resources	55	4.4545	.74082
Nestle Kenya recognizes information resources as a part of its asset base.	55	4.6182	.59289
Nestle Kenya's senior management have a positive attitude towards knowledge management.	55	4.3636	.61955
Nestle Kenya provides knowledge-management training for new technologies.	54	4.1481	.87755
Nestle Kenya utilizes internet and intra-net channels to obtain information.	55	4.6182	.59289
Average		4.4405	.68474
Valid N (listwise)	54		

It is depicted from the above outcomes in Table 4.9 that the highest mean of 4.6182 is of the attributes "Nestle Kenya recognizes information resources as a part of its asset base" and "Nestle Kenya utilizes internet and intra-net channels to obtain information", they both exhibit a standard deviation of 0.59289. The lowest mean is of the attribute "Nestle Kenya provides knowledge-management training for new technologies", with a mean of 4.1481 and a standard deviation of 0.87755. The attribute "I consider Nestle Kenya as a knowledge-based firm, it efficiently handles information resources" has a mean of 4.4545 and a standard deviation of 0.74082. The attribute "Nestle Kenya's senior management has a positive attitude towards knowledge management" has a mean of 4.3636 and a standard deviation of 0.61955. The overall attributes had an average mean of 4.4405 with a standard deviation of

0.68474. This gives an implication that Nestle Kenya exhibits to a very high extent knowledge management as one of the aspects of IT.

4.4.4 Lean Production Implementation

Interviewees were asked to assess the attributes of lean production implementation in Nestle Kenya. An ordinal measurement scale was utilized to measure the variable through a five-point Likert scale in measuring the respondents' perception towards lean production implementation in Nestle Kenya. Consequently, lean production implementation statistics were derived, and the outcomes exhibited in Table 4.12.

Table 4.12: Lean Production Implementation Descriptive Statistics

	N	Mean	Std. Deviation
Nestle Kenya implements a fabrication method in which materials or parts are shipped immediately until they are needed to reduce the cost of storage.	55	4.6182	.59289
Nestle Kenya implements a manufacturing system where the time it takes to complete equipment changeovers is drastically reduced.	54	3.5185	1.09442
Nestle Kenya has a visual workflow management system.	54	3.9630	.97057
Nestle Kenya implements A self-managed repair program where machine operators are responsible for regular maintenance including machine and machinery operations.	54	3.8519	.97917
Nestle Kenya has a system of continual process of detecting and reducing or eliminating errors and wastages in production.	54	4.0185	.85761
Average		3.9940	.8989
Valid N (listwise)	54		

The study findings display that the highest mean of 4.6182 is of the attribute "Nestle Kenya implements a manufacturing system in which materials or components are delivered immediately before they are required in order to minimize storage costs", which exhibits a standard deviation of 0.59289. The lowest mean of 3.5185 is of the attribute "Nestle Kenya implements a manufacturing system where the time it takes to complete equipment changeovers is drastically reduced", a 1.09442 standard deviation. The attribute "Nestle Kenya has a system of continual process of detecting and reducing or eliminating errors and wastages in production." has a mean of 4.0185 and 0.85761 as standard deviation. The attribute not "Nestle Kenya has a visual workflow management system" has a mean of 3.9630 and a standard deviation of 0.97057. The attribute "Nestle Kenya implements a self-directed maintenance system, where machine operators are responsible for the routine maintenance and operations of their machines and equipment" has an average of 3.8519 and a 0.97917 standard deviation. The overall attributes had an average mean of 3.9940 with a standard deviation of 0.8989. This gives an indication that Nestle Kenya exhibits to a high extent lean production implementation.

4.5 Diagnostic Tests

Diagnostic tests done in this study included; normality tests, homoscedacity tests, multicollinearity tests, and autocorrelation tests. Normality test was carried out using Shapiro Wilk test, which was supplemented by the Kolmogorov-Smirnov test. The homoscedacity test was conducted through the Breusch-Pagan test. Tests on Multicolinearity of data was carried out using VIF and Tolerance tests. The autocorrelation test was done through the Durbin-Watson stastic.

4.5.1 Normality Test

The normality tests for all the variables employed in the study are highlighted in Table 4.13.

Table 4.13: Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Lean_Prod_Implementation	.236	55	.000	.850	55	.000
Knowledge_Mgt	.347	55	.000	.712	55	.000
Internal_IT_Integration	.291	55	.000	.747	55	.000
External_IT_Integration	.241	55	.000	.831	55	.000

a. Lilliefors Significance Correction

In testing for normality of the data, the null hypothesis holds that the data has a normal distribution. The level of significance adopted in the study is 5%. Since the significance values in both tests for all the variables are less than the α (0.05), the null hypothesis is rejected. Hence, the data series of the variables are not normally distributed.

4.5.2 Test for Homoscedacity

The homoscedacity tests for all the predictor variables employed in the study are enlisted in Table 4.14.

Table 4.14: Test for Homoscedacity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity **Ho: Constant variance** **Variables: fitted values of ROA**	**chi2(1)**	**Prob > chi2**
Knowledge_Mgt	77.956	1.00
Internal_IT_Integration	64.51	1.00
External_IT_Integration	34.678	1.00

a. Dependent Variable: Lean_Prod_Implementation

The null hypothesis is that there is homoscedacity. The level of significance adopted in the study is 5%. Since the significance values in both tests for all the variables are greater than the α (0.05), the null hypothesis is not rejected. Hence, the data series of all the predictor variables are homoscedastic.

4.5.3 Test for Multicollinearity

Results on Test for Multicolinearity of data carried out using Variance Inflation Factors (VIF) are displayed in Table 4.15.

Table 4.15: Multicollinearity Statistics

Model		Collinearity Statistics	
		Tolerance	VIF
1	Knowledge_Mgt	.785	1.274
	Internal_IT_Integration	.683	1.465
	External_IT_Integration	.812	1.232

a. Dependent Variable: Lean_Prod_Implementation

The common rule in statistics is that tolerance values should be graeter than 0.1 and VIF values should be less than 10 and greater than 1. The findings indicate that that tolerance values exceed 0.1 while VIF values fall below 10 and greater than 1. Hence, there is no presence of multicollinearity amongst predictor variables included in the model.

4.5.4 Tests for Autocorrelation

The result on the autocorrelation test carried out using the Durbin-Watson Statistic is presented on Table 4.16.

Table 4.16: Autocorrelation Test

Model	Durbin-Watson
1	1.883[a]

a. Predictors: (Constant), External_IT_Integration, Knowledge_Mgt, Internal_IT_Integration

b. Dependent Variable: Lean_Prod_Implementation

The Durbin-Watson statistic ranges from point 0 and point 4. If there exist no correlation between variables, a value of 2 is shown. If the values fall under point 0 up to a point less than 2, this is an indication of an autocorrelation and on the contrast a negative autocorrelation exist if the value falls under point more than 2 up to 4. As a common rule in statistics, value falling under the range 1.5 to 2.5 is considered relatively normal whereas values that fall out of the range raise a concern. Field (2009) however, opines that values above 3 and less than 1 are a sure reason for concern. Therefore, the data used in this panel is not serially autocorrelated since it meets this threshold.

4.6 Inferential Statistics

Inferential statistics are used in determining the direction, relationship, and strength of the association between the predictor variables and the response variable. The section entails the inferential statistics employed in the study, which included correlation and regression analysis. The attributes constituting the various variables were summarized to create a whole variable. This was achieved by estimating the median value of all the attributes.

4.6.1 Internal IT Integration and Lean Production

The first goal was to assess the effect of internal IT integration on the lean product. Inferential statistics that included correlation and simple linear regression analysis were utilized.

4.6.1.1 Correlation Analysis

Correlation analysis establishes whether there exists an association among two variables. The association falls between a perfect positive and a strong negative correlation. The study used Pearson Correlation. This study employed a Confidence Interval of 95% and a two tailed test. Table 4.17 displays that internal IT integration is significantly correlated at the 5% significance level to lean production implementation. They have a positive significant association.

Table 4.17: Correlation Analysis

		Lean_Prod_Implementation	Internal_IT_Integration
Lean_Prod_Implementation	Pearson Correlation	1	.324*
	Sig. (2-tailed)		.016
Internal_IT_Integration	Pearson Correlation	.324*	1
	Sig. (2-tailed)	.016	
	N	55	55

4.6.1.2 Simple Linear Regression Analysis

The analysis variables were evaluated using a basic linear regression model.. The regression analysis was assumed at the 5% significance level. The significance critical value exhibited from the Analysis of Variance and Model Coefficients were compared with the values obtained in the analysis. When internal IT integration was regressed against lean production, the findings are displayed form Table 4.18 through to Table 4.20.

Table 4.18: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.324[a]	.105	.088	.83177

a. Predictors: (Constant), Int_IT_Int

R^2 indicates deviations in response variable as a consequence of differences in predictor variables. From Table 4.18, the R^2 value is 0.105, a discovery that 10.5% of the deviations in lean production are caused by internal IT integration. Other factors not incorporated in the model justify for 89.5% of the variations in lean production implementation. The other factors include; manufacturing planning and control, new product development, process and equipment, concurrent engineering, workforce management, customer relationship, and supplier relationship (Bell, 2005).

Table 4.19: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.314	1	4.314	6.236	.016[b]
	Residual	36.667	53	.692		
	Total	40.982	54			

a. Dependent Variable: Lean_Prod

b. Predictors: (Constant), Int_IT_Int

The null hypothesis is that internal IT integration significantly influences lean production. The significance value obtained in the study is less than critical value of 0.05. Consequently, the null hypothesis has been refuted. Thus, internal IT integration significantly affects lean

production. Therefore, Internal IT integration can significantly predict lean production implementation.

Table 4.20: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.161	.738		2.929	.005
	Int_IT_Int	.416	.166	.324	2.497	.016

a. Dependent Variable: Lean_Prod

The null hypothesis was that there was no substantial association between internal IT development and lean growth. Internal IT integration has a significance value below the critical significance value of 0.05. Thus, the null hypothesis is rejected. Therefore, internal IT integration has a huge positive influence on lean production. The following model was thus developed;

$Y = 2.161 + 0.416X$

This implies that when there is no internal IT integration, there are 2.161 units of lean production. Subsequently, when one improves internal IT integration by one unit, there is an increase in lean production by 0.416 units.

4.6.2 External IT Integration and Lean Production

The second goal was to assess the effect of external IT integration on lean production. Inferential statistics that included correlation and simple linear regression analysis were utilized.

4.6.2.1 Correlation Analysis

Table 4.21 displays that external IT integration is significantly correlated at the 5% significance level to lean production. They have a positive significant association.

Table 4.21: Correlation Analysis

		Lean_Prod	Ext_IT_Int
Lean_Prod	Pearson Correlation	1	.284*
	Sig. (2-tailed)		.035
Ext_IT_Int	Pearson Correlation	.284*	1
	Sig. (2-tailed)	.035	
	N	55	55

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

4.6.2.2 Simple Linear Regression Analysis

When external IT integration was regressed against lean production, the findings are displayed form Table 4.22 through to Table 4.24.

Table 4.22: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.284[a]	.081	.063	.84306

a. Predictors: (Constant), Ext_IT_Int

From Table 4.22, the R square value is 0.081, a discovery that 8.1% of the deviations in lean production are caused by external IT integration. Other factors not incorporated in the model justify for 91.9% of the variations in lean production. The other factors include; manufacturing planning and control, new product development, process and equipment, concurrent engineering, workforce management, customer relationship, and supplier relationship (Bell, 2005).

Table 4.23: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.312	1	3.312	4.660	.035[b]
	Residual	37.670	53	.711		
	Total	40.982	54			

a. Dependent Variable: Lean_Prod

b. Predictors: (Constant), Ext_IT_Int

The null hypothesis is that external IT integration does not significantly influence lean production. The significance value obtained in the study is less than the critical value of 0.05. Consequently, the null hypothesis is rejected. Thus, external IT integration significantly affects lean production. Therefore, external IT integration can significantly predict lean production implementation.

Table 4.24: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.655	.625		4.248	.000
	Ext_IT_Int	.331	.153	.284	2.159	.035

a. Dependent Variable: Lean_Prod

The null hypothesis was that there was no justifiable association between external IT integration and lean production. It is displayed from the findings that external IT integration has a significance value below the critical significance value of 0.05. Thus, the null hypothesis is rejected. Therefore, external IT integration has a major positive impact on lean production. The following model was thus developed;

$$\mathbf{Y = 2.655 + 0.331X}$$

This implies that when there is no external IT integration, there are 2.655 units of lean production. Subsequently, when one improves external IT integration by one unit, there is an increase in lean production by 0.331 units.

4.6.3 Knowledge Management, IT Integration, and Lean Production

The first aim was assessing the moderating influence of knowledge management on the relationships between both internal and external IT integration and lean production. Inferential statistic applied was the hierarchical multiple linear regression analysis.

The hierarchical multi-linear regression model was utilized to check the moderating impact of knowledge management on the association amongst internal IT integration and lean production.. The findings are displayed form Table 4.25 to Table 4.27.

Table 4.25: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.324[a]	.105	.088	.83177	.105	6.236	1	53	.016
2	.348[b]	.121	.088	.83211	.016	.957	1	52	.333

a. Predictors: (Constant), Int_IT_Int

b. Predictors: (Constant), Int_IT_Int, Know_Mgt

From Table 4.25, the addition of knowledge management contributes an additional 1.6% variance in lean production. Thus, it increases the explanatory power above and beyond that which was accounted for by only internal IT integration. The null hypothesis is that there is no significant moderating effect of knowledge management on the connection amongst internal IT integration and lean production. The significance F. change value is higher than the alpha (0.05). Thus, the null hypothesis is refuted. This implies that the increase in knowledge management does not produce a statistically significant increase in variance accounted for lean production. Therefore, knowledge management does not perform a major moderating role in the association of internal IT transformation and lean output

Table 4.26: Analysis of Variance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.314	1	4.314	6.236	.016[b]
	Residual	36.667	53	.692		
	Total	40.982	54			
2	Regression	4.977	2	2.488	3.594	.035[c]
	Residual	36.005	52	.692		
	Total	40.982	54			

a. Dependent Variable: Lean_Prod

b. Predictors: (Constant), Int_IT_Int

c. Predictors: (Constant), Int_IT_Int, Know_Mgt

The null hypothesis is that the model consisting of internal IT integration and knowledge management does not significantly influence lean production. The significance value obtained in the study is below critical value of 0.05. Consequently, the null hypothesis is refuted. Thus, internal IT integration and knowledge management significantly affect lean production. Introduction of the knowledge management in the model does not change the significance, but the significance value changes from 0.016 to 0.035.

Table 4.27: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.161	.738		2.929	.005
	Int_IT_Int	.416	.166	.324	2.497	.016
2	(Constant)	1.540	.973		1.582	.120
	Int_IT_Int	.331	.188	.259	1.766	.083
	Know_Mgt	.219	.224	.143	.978	.333

a. Dependent Variable: Lean_Prod

The significance value of internal IT integration reduces from 0.16 in the first model to 0.083 in the second model. Thus in the second model, there is no substantial correlation between internal IT integration and lean production. The introduction of knowledge management has changed the significance of internal IT integration.

The hierarchical multiple linear regression analysis was also applied in testing for the moderating effect of knowledge management on the relationship between external IT integration and lean production, the findings are displayed from Table 4.28. to Table 4.30.

Table 4.28: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.284[a]	.081	.063	.84306	.081	4.660	1	53	.035
2	.346[b]	.120	.086	.83287	.039	2.304	1	52	.135

a. Predictors: (Constant), Ext_IT_Int

b. Predictors: (Constant), Ext_IT_Int, Know_Mgt

From Table 4.28, the addition of knowledge management contributes an additional 3.9% variance in lean production. Thus, it increases the explanatory power above and beyond that which was accounted for by only external IT integration. The null hypothesis is that there is no important moderating effect of knowledge management on the association amongst external IT integration and lean production. The significance F. change value is greater than the alpha (0.05). Thus, the null hypothesis is not refuted. This implies that the increase in knowledge management does not produce a statistically significant increase in variance accounted for lean production. Therefore, Knowledge management plays no major moderating role in the association between external IT integration and LP.

Table 4.29: Analysis of Variance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3.312	1	3.312	4.660	.035[b]
	Residual	37.670	53	.711		
	Total	40.982	54			
2	Regression	4.910	2	2.455	3.539	.036[c]
	Residual	36.071	52	.694		
	Total	40.982	54			

a. Dependent Variable: Lean_Prod

b. Predictors: (Constant), Ext_IT_Int

c. Predictors: (Constant), Ext_IT_Int, Know_Mgt

The null hypothesis is that the model consisting of external IT integration and knowledge management does not significantly influence lean production. The significance value obtained in the study is below the critical value of 0.05. Consequently, the null hypothesis is refuted. Thus, external IT integration and knowledge management significantly affect lean production. Introduction of the knowledge management in the model does not change the significance, but the significance value changes marginally from 0.035 to 0.036.

Table 4.30: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.655	.625		4.248	.000
	Ext_IT_Int	.331	.153	.284	2.159	.035
2	(Constant)	1.482	.989		1.498	.140
	Ext_IT_Int	.272	.156	.233	1.737	.088
	Know_Mgt	.312	.206	.204	1.518	.135

a. Dependent Variable: Lean_Prod

The significance value of external IT integration reduces from 0.035 in the first model to 0.088 in the second model. Thus in the second model, there is no substantial association between external IT integration and lean production. The introduction of knowledge management has changed the significance of external IT integration.

4.7 Discussion of Findings

The study intention was to ascertain the effect of the IT aspects on lean production implementation. Influence of each of the predictor variable on the response variable was analyzed in terms of strength and direction. The descriptive statistics indicate that lean production implementation is exhibited to a high extent in Nestle Kenya. The descriptive statistics also display that the IT integration included in the study are exhibited to a high extent in Nestle Kenya.

The study findings were similar to the finding of the report by the Boston Consulting Group (2012), which concluded that Lean-IT enables smooth material and information flow within the enterprise and this can be attributed to new IT packages like ERP and MRP which have been advanced in the global market for making improving the effectiveness and efficiency of business operations. The study conclusions are also in tandem by the conclusion of the study conducted by Bell (2005), the study concluded that IT support can lead to improvement of lean performance. Lean-IT pinpoints the key elements of information system in the enterprise for seamless flow of information.

The study findings are also congruent to findings of the study done by Staats, Brunner and Upton (2011), which stipulated that IT in enterprise can lead to successful lean implementation. It further stated that through integration of lean and IT, this would lead to elimination of misalignment and consequently lead to exact product with minimum waste and the precise technology required for avoidance of the confusion existing between IT and lean is either ERP or MRP. This is achieved through integration of IT and lean whereby the enterprise keeps the clients orders, purchasing and financial data. The study is also in tandem with a report by SAP (2007), which stated that the best technology tool for improving the operations of a business is ERP systems, a combination of lean approaches and enterprise software might translate to transparency in inventory monitoring and causes instant response to clients' order changes, technology and lean integration enables untreatable management and business intelligence.

The study is congruent to the study conducted by Kobus, Westner, and Strahringer (2016) conducted a study on lean management of IT organizations, which established that lean IT could benefit IT organizations in three areas in which include; increased transparency, improved demand management, and increased skill management. The study is also similar the study conducted by Moyano-Fuentes et al. (2012), who did a study on influence of usage of information technology on lean production implementation with focus in the automotive sector. The study established that the degree of implementation of lean production was carried out in accord with the level of use plus the type of IT being implemented whether external or internal. The research findings exhibited that organizations require to supplement the level of usage of internal or intra-organizational IT so as to raise the degree of execution of LP hence improving efficacy. In addition, the findings showed that external or inter-organizational IT solely has a significant adverse impact on the degree of LP implementation when internal IT is measured.

4.7.1 Internal IT Integration and Lean Production Implementation

Descriptive statistics indicate that internal IT integration is exhibited to a very high extent in Nestle Kenya. The correlation analysis findings displayed that internal IT integration had a positive significant association with lean production implementation. Additionally, the regression analysis exhibited that internal IT integration has a significant positive impact on lean production implementation.

The study findings are in conformity to study conclusions by Schlie and Goldhar (1995) and Small (1999), which concluded that internal IT incorporation can be implemented to generate data together with facilitating sharing of information amongst organizations which can improve an organization's capabilities in terms of production. Schlie and Goldhar (1995) further established that the changes that happened in U.S. manufacturing was as a consequence of computer-integrated manufacturing technology, comprising greater throughput speed together with client responsiveness competences. The study conclusions are also parallel to a conclusion by the study conducted by Attaran (1989), which concluded that intra-firm information systems allow industrialists to provide a wider range of produces by limiting setup time, therefore allowing minor batch runs, that lead to condensed lead periods. The study finding is in tandem with the study undertaken by Co et al. (1998) discovered that utilization of an information system in a business reduces lead times.

The study finding is congruent to the study done by Bharadwaj (2000) which found out that Internal IT systems, like for instance, advanced planning together with scheduling, can aid aid in elimination of bottleneck and enable reduction cycle time. Lot size reduction together with quick changeover approaches can offer timely response to information systems like MRP and forecast demand managing software, that could heighten that IT systems responsiveness results into minimized customer lead time

The study is also similar to the study conducted by Bhaskar and Sayed (2009) on the role of IT in lean enterprise systems. The study established that; IT offers essential data for the clients pertaining to quality, new features together with product design of the new products. IT performs a significant role in the safekeeping of information in the business. In addition, Information technology offers security to the clients pertaining delivery of product and details of product. Lean management systems offer new ideas regarding the nonviable and needless undertakings in the business since lean minimizes wastes and develops client satisfaction. The current study contradicts the study by Karmarkar (1989), which found out that integrating MRP systems together with JIT systems could enhance the efficacy of manufacturing system.

4.7.2 External IT Integration and Lean Production Implementation

Descriptive statistics indicate that external IT integration is exhibited to a high extent in Nestle Kenya. The correlation analysis findings displayed that external IT integration had a positive significant association with lean production implementation. Additionally, the regression analysis exhibited that external IT integration has a significant and positive effect on lean production implementation.

The study finding is in tandem to the study finding by Mason-Jones and Towill (1999), which proposed that information-enriched supply chain concept proposed separates the lead-time in a supply chain into material movement together with info movement lead time and organizations are more linked internally plus externally in an information-enriched supply chain as a result of information distribution causing reduced info lead-time plus reduced total lead time in a supply sequence. The study finding is parallel to the study by Galbraith (1973), which opined that external IT integration decreases the decision-making procedure leading to data integration essential for information to aid as a shared language for the dealings taking place in the firm. It also conforms to the study conducted by Huber (1982), which stipulated

inadequate information integration leads to postponements, reductions in communication plus bigger misrepresentation of significance.

The study finding are in tandem with the study by Dennis (1996) that outlined that external IT integration helps supply chain partners in attaining common decisions through exchange of information, standardization and recollection. The study finding also conforms to the study done by Cachon and Fisher (2000), which established that external IT combination reduces lead-time, allocation of demand together with inventory information could reduce the order processing lead-time. The study finding is also congruent to the study conducted by Lee, So, and Tang (2000), which studied information sharing in a two-level supply chain and established that sharing the present demand variation data tips to vital inventory decrease that is usually connected with lessened lead times.

4.7.3 IT Integration, Knowledge Management and Lean Production Implementation

Descriptive statistics indicate that knowledge management is exhibited to a very high extent in Nestle Kenya. The hierarchical multiple linear regression analysis exhibited that knowledge management lacked a significant moderating role on both internal and external IT integration relationship with lean production.

The study finding is not consistent to the Knowledge Based View theory, which stipulates that knowledge can be demonstrated in many forms and transferred from one person to another within and outside the organization hence ensuring continuity and continuous improvement. It is also not congruent to the report by SAP (2007) which stipulated that real time management is enabled by availability of knowledge and data sharing within an enterprise and also triggers the important factors that perform a key part if lean for example business intelligence and analytics.

The study is divergent to the study by Long et al. (2005), which stated that knowledge managing drastically cut costs and better the understanding regarding the office leads to safe together with less risky job surroundings. The study also revealed that the management of knowledge at all times follows the principle of smart work, which entails logical thinking and less physical plus mental struggle, consequently reducing the product life cycle time in the long run saving in time together with expenses. Finally, the study established that choice making would be easy as knowledge managing offers essential information together with data

pertaining to every section in the enterprise. It is also not in tandem with the study done by Hicks, Galup, and Dattero (2006) which stated that recognizing, capturing, recovering, sharing, and assessing an organization's information resources can be done via an integrated methodology that is aided by knowledge management sponsor. The study is also not similar to the study conducted by Pyke and Cohen (1990), which established that Control systems like JIT systems use local information for control.

CHAPTER FIVE: SUMMARY, DISCUSSIONS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This section shows the study findings summary, offered conclusions, and recommendations on the effect of information technology on lean production in Nestle Kenya. Additionally, the research limitations and further research suggestions are also outlined.

5.2 Summary

This study intention were; investigating the magnitude to which internal IT integration impacts lean production implementation at Nestle Kenya, establishing out how external IT integration influences lean production implementation at Nestle Kenya, and scrutinizing the role of knowledge management in the association amongst IT integration and lean production at Nestle Kenya. Thus, the data analysis, presentation, interpretation, and discussion of findings of the study were as per the aforementioned specific objectives. The study employed the use of descriptive, regression, and correlation analysis. The descriptive statistics indicate that lean production implementation is exhibited to a high extent in Nestle Kenya.

5.2.1 Internal IT Integration and Lean Production Implementation

Descriptive statistics indicate that internal IT integration is exhibited to a very high extent in Nestle Kenya. The correlation analysis findings displayed that internal IT integration had a positive significant association with lean production implementation. The regression analysis exhibits that internal IT integration has a significant positive impact on LP implementation.

5.2.2 External IT Integration and Lean Production Implementation

Descriptive statistics indicate that external IT integration is exhibited to a high extent in Nestle Kenya. The correlation analysis findings displayed that external IT integration had a positive significant association with lean production implementation. The regression analysis exhibits that external IT integration has a notable positive impact on lean production implementation.

5.2.3 IT Integration, Knowledge Management, and Lean Production Implementation

Descriptive statistics indicate that knowledge management is exhibited to a very high extent in Nestle Kenya. The hierarchical multiple linear regression analysis exhibited that

knowledge management failed to have a significant moderating role on both internal and external IT integration.

5.3 Conclusion

In this section, the conclusion of the study is given; the conclusions were affiliated to the study objectives. The broad study objective was to explore the influence of information technology on lean production implementation at Nestle Kenya. The specific objectives of the study were; to explore the magnitude to which internal IT integration impacts lean production implementation at Nestle Kenya, to find out how external IT integration influences lean production implementation at Nestle Kenya, and to find out the role that knowledge management plays in the two relationships.

5.3.1 Internal IT Integration and Lean Production Implementation

The study concluded that internal IT integration had a positive significant association with lean production implementation and a positive significant effect on lean production. The study conclusions are parallel to study conclusions by Schlie and Goldhar (1995) and Small (1999), which concluded that internal IT incorporation can be implemented to generate data together with facilitating sharing of information amongst organizations which can improve an organization's capabilities in terms of production. Schlie and Goldhar (1995) further concluded that the changes that happened in U.S. manufacturing was as a consequence of computer-integrated manufacturing technology, comprising greater throughput speed together with client responsiveness competences. The study conclusions are also parallel to a conclusion by the study conducted by Attaran (1989), which concluded that intra intra-firm information systems allow industrialists to provide a wider range of produces by limiting setup time. This will enable minor batch runs of which end result lead to condensed lead periods.

5.3.2 External IT Integration and Lean Production Implementation

The study concluded that that external IT integration had a positive significant association with lean production implementation and a positive significant effect on lean production. The study conclusion is in tandem to the study conclusion by Mason-Jones and Towill (1999), which concluded that an information-enriched supply chain separates the lead-time in a supply chain into material movement together with info movement lead-time. The study conclusions is also parallel to the study by Galbraith (1973), which concluded that external IT

integration decreases the decision-making procedure leading to data integration essential for information to aid as a shared language for the dealings taking place in the firm.

5.3.3 IT Integration, Knowledge Management, and Lean Production Implementation

The study concluded that that knowledge management did not have a significant moderating role on both internal and external IT integration relationship with lean production. The study conclusion is contradictory to the Knowledge Based View theory, which stipulates that knowledge can be demonstrated in many forms and transferred from one person to another within and outside the organization hence ensuring continuity and continuous improvement. The study conclusion is also not congruent to the report by SAP (2007) which stipulated that time management is enabled by availability of knowledge and data sharing within an enterprise and also triggers the important factors that perform a key part if lean for example business intelligence and analytics.

The study conclusion is divergent to the conclusion of the study conducted by Long et al. (2005), which concluded that knowledge managing drastically cut costs and better the understanding regarding the office leads to safe together with less risky job surroundings. Finally, the study conclusion is also not in tandem with conclusion of the study done by Hicks, Galup, and Dattero (2006) which concluded that management of knowledge makes the business resourceful and effective in terms of making policy, strategic planning, harmonization amongst employees together with data sharing by facilitating the advanced technology and updated data.

5.4 Recommendations

The recommendations of the study were conducted in accordance to the study objectives. the recommendations are enumerated in this section.

5.4.1 Internal IT Integration and Lean Production Implementation

The study established that internal IT integration had a positive significant association with lean production implementation and a significant positive effect on lean production. Thus, the study makes recommendations to the policy makers in the ministry of trade and industrialization, Kenya Association of Manufacturers (KAM), Kenya National Chamber of Commerce and Industry (KNCCI), other bodies, practitioners in the industrial sector, and consultants to implement internal IT integration in order to boost lean production. Thus, the

stakeholders should engage IT in human resource management, customer credit procedures, product development and research, risk management systems, and ERP systems.

5.4.2 External IT Integration and Lean Production Implementation

The study established that external IT integration had a positive significant association with lean production implementation and a positive significant effect on lean production. Thus, the study makes recommendations to the policy makers in the ministry of trade and industrialization, KAM, KNCCI, other bodies, practitioners in the industrial sector, and consultants to implement external IT integration in order to boost LP implementation. Thus, they should engage IT in customer relationship management and marketing processes. In addition, they should divide lead-time in a supply chain into electronic ordering information lead-time and physical material movement lead-time, share demand and inventory data with suppliers/distributers to shorten the order processing lead time, and utilize IT systems in the procurement process to select the most appropriate supplier.

5.4.3 IT Integration, Knowledge Management, and Lean Production Implementation

The study recognized that knowledge management did not have a significant moderating role on both internal and external IT integration relationship with lean production. However, according to the knowledge based view theory and other relevant literature, knowledge management did not have a significant moderating role on both internal and external IT integration relationship with lean production. Thus, the study makes recommendations to the policy makers in the ministry of trade and industrialization, KAM, KNCCI, other bodies, practitioners in the industrial sector, and consultants should utilize knowledge management when utilizing IT integration to augment lean production.

5.5 Recommendations for Further Study

Exploring the influence of information technology on lean production implementation is of great importance the policy makers in the ministry of trade and industrialization, KAM, KNCCI, other bodies, practitioners in the industrial sector, and consultants. However, the current study was carried out in Nestle Kenya and the same study could be carried out across other institutions in the industrial sector and across other sectors to establish if the study findings will hold. The study was only carried out in Kenya, further studies can be conducted out of Kenyan context, they can be conducted in the African or global jurisdictions to establish whether the study findings would hold.

The study only considered the IT aspects of knowledge management, internal IT integration, and external IT integration, a study can be conducted to ascertain it there are other IT aspects. Further studies can be conducted to ascertain if there are factors that moderating the relationship between IT aspects and lean production implementation. Several attributes were determined in the study as constituting the IT aspects and lean production implementation, further studies can be conducted to ascertain if other attributes can represent them.

This study only used primary data source, a subsequent research should be undertaken applying secondary data. This can either complement or criticize the finding of this study. Multiple linear regression and correlation analysis were applied in the study; Other analysis technique for example cluster analysis, discriminant analysis, granger causality and factors should be incorporated in the subsequent research.

5.6 Limitations of the Study

The study was conducted only in Nestle Kenya due to time and cost constraints which does not give clear indication of findings if other sectors were also incorporated in the study. More uncertainties would occur if similar studies were replicated in different companies, sectors, and countries. Although the research engaged primary sources of data by utilizing questionnaires, major challenges like non-responsiveness of respondents or misunderstanding of the questionnaire were encountered. Raw data could also not be utilized hence, it needed to be coded with the assistance of a SPSS to achieve a synchronized information that can be compiled and conclusions drawn. The process also consumed some considerable amount of time in compiling and recurrent delays of synchronizing the data.

REFERENCES

Adom, D., Kamil Hussein, E., & Adu Agyem, J. (2018) Theoretical and conceptual framework: Mandatory ingredients of a quality research. *International Journal of Scientific Research 7(1), 438-441.*

Ahlstrom, P., (2004). Lean service operations: translating lean production principles to service operations. *International Journal of Services Technology and Management.*

Attaran, M. (1989). The automated factory: Justification and implementation. *Business Horizon, 32(3), 80–86.*

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17 (1), 99-120.*

Beamon, B. M., (2009). Measuring supply chain performance. *International Journal of Operations & Production Management, 19(3), 275-292.*

Bell, S. (2005). *Lean enterprise systems: Using IT for continuous improvement.* Wiley-Interscience.

Bharadwaj, A. (2000). A resource-based perspective on information technology capability and firm performance: An empirical investigation. *MIS Quarterly, 24(1), 169–196.*

Bhaskar, D., & Sayed, P. D., (2009). *Role of Information Technology in lean enterprise systems.* Unpublished Master's Thesis, University College of Borås, School of Engineering.

Bruun, P., & Mefford, R. N., (2004). Lean production and the internet. *International Journal of Production Economics, Vol. 89, No. 3, pp.247–260.*

Cachon, G., & Fisher, M. (2000). Supply chain inventory management and the value of shared information. *Management Science, 46 (8), 1032–1048.*

Castells, M. (1996). *The rise of the network society.* Oxford: Blackwell.

Cavusgil, S. T, Calantone, R. J & Zhoa, Y. (2003). Tacit Knowledge Transfer and Firm Innovation Capability. *Journal of Business and Industrial Marketing*, 18(1): 6-21.

Co, H., Patuwo, E., & Hu, M. (1998). The human factor in advanced manufacturing technology adoption: An empirical analysis. *International Journal of Operations and Production Management, 18(1), 87–106.*

Cooper, D. R., & Schindler, P. S. (2014). *Business research methods* (10th ed.). New Delhi: Tata McGraw-Hill Publishing Company Limited.

Cronbach, L. J., (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16, 297-334.*

Davenport, T. H. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review, 76(4), 121–131.*

Dennis, A. (1996). Information exchange and use in group decision making: You can lead a group to information, but you cannot make it think. *MIS Quarterly, 20(4), 433–457.*

Found, P., (2006). The role of information technology in lean change. Cardiff Logistics & Operations Management Working Papers.

Frohlich, M. (2002). E-integration in the supply chain: Barriers and performance. *Decision Sciences, 33 (4), 537–556.*

Fullerton, R. R., McWatters, C. S., & Fawson, C. (2003). An examination of the relationships between JIT and financial performance. *Journal of Operations Management, 21(4), 383–404.*

Galbraith, J. (1973). *Designing complex organizations.* Reading, MA: Addison-Wesley.

Gall, K., Knight, D. W., Carlson, L. E., & Sullivan, J. F., (2006). Making the grade with students: The case for accessibility. *Journal of EngineeringEducation 92 (4): 337-43.*

Germain, R. and Iyer, K.N.S. (2006). The interaction of internal and downstream integration and its association with performance. *Journal of Business Logistics. Vol. 27 No. 2, pp. 29-52.*

Golafshani, N.,. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-606.

Goldratt, E. M., & Cox, J., (2004). *The Goal: A process of ongoing improvement.* (3rd ed).

Grant, C., & Onsanloo, A. (2014) Understanding, Selecting and integrating theoretical framework in dissertation research: Creating the blueprint for 'House' *Administrative Issues Journal 4(2), 4.*

Grewal, D., Janakiraman, R., Kalyanam, K., Kannan, P. K., Ratchford, B., Song, R., & Tolerico, S., (2010). Strategic online and offline retail pricing: A review and research agenda. *Journal of Interactive Marketing. 24. 138-154. 10.1016/j.intmar.2010.02.007.*

Hicks, R. C., Galup, S. D., & Dattero, R., (2006). The transformations in the five tier knowledge management transformation matrix. *Journal Of Knowledge Management, 10 (1), 19-31.*

Hines, P., Howlweg, M., & Rich, N., (2004). Learning to evolve: A review of the contemporary lean thinking . *International Journal of Operations & Production Management, 24*(10), 994- 1011.

Holweg, M., (2007). The genealogy of lean production. *Journal of Operations Management, Vol. 25, No. 2, pp.420–437.*

Homer, G., & Thompson, D., (2001). The contribution of internet technology in achieving lean management within British automotive supply chains. *International Journal of Automotive Technology and Management, Vol. 1, Nos. 2–3, pp.369–378.*

Hopp, W. J., & Spearman, M. L., (2004). To pull or not to pull: what is the question? *Manufacturing & Service Operations Management, Vol. 6, No. 2, pp.133–148.*

Huber, G. (1982). Organization information systems: Determinants of their performance and behavior. *Management Science, 28(2), 138–155.*

Jaideep, M., Hung, C., & Manu, M., (1996). Implementation of ISO 9000 in the healthcare sector: A case study. *Health Marketing Quarterly, 14(2), 63–72.*

Jayaram, J., & Xu, K., (2016). Determinants of quality and efficiency performance in service operations. *International Journal of Operations & Production Management, 36*(3), 265–285.

Ju, T. L., Li, C. Y. & Lee, T. S. (2006). A contingency model for knowledge management capability and innovation. *Industrial Management and Data System*, 106(6): 855-877.

Juran, J. M., & Godfrey, A. B., (1998). *Juran's Quality Handbook. McGrawHill.*

Karlsson, C., & Ahlström, P., (1996). Assessing changes towards lean production. *International Journal of Operations & Production Management, Vol. 16, No. 2. pp.24–41.*

Karmarkar, U. (1989). Getting control of just-in-time. *Harvard Business Review, 67(5), 122–131.*

Kim, G., Shin, B., Kim, K. K., & Lee, H. G. (2011). IT capabilities, process-oriented dynamic capabilities, and firm financial performance. *Journal of the Association for Information Systems, 12(7), 487-517.*

Kobus, J., Westner, M., & Strahringer, S., (2016). *Lean management of IT organizations: A perspective of IT slack theory.* ICIS.

Kothari, C. R., (2003). *Research methodology, methods, and techniques.* Wisha Prakashan, New Delhi.

Kothari, C. R., (2004). *Research Methodology: Methods and Techniques.* New Delhi. New Age International Publishers, p.8.

Krafcik, J.F., (1988). Triumph of the lean production system. *Sloan Management Review, Vol. 30, No. 1, pp.41–52.*

Lai, K. H., Wong, C. W., & Cheng, T. E., (2011). Institutional isomorphism and the adoption of information technology for supply chain management. *Computers in Industry, 57(1), 93-98.*

Lee, H., So, K.,& Tang, C.(2000). The value of information sharing in a two-level supply chain. *Management Science, 46(5), 626–643.*

Levine, R., (1988). Financial development and economic growth: views and agendas. *Journal of Economic Literature (35), 688-726.*

Li, S., Rao, S. S., Ragu-Nathan, T. S., & Ragu-Nathan, B. (2005). Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management, 23(6), 618–641.*

Long, L. N., Marling, L., Bailey, M., DeLoach, R., & Secor, D., (2005). *Understanding the application of knowledge management in a technology driven industry.* American Institute of Aeronautics and Astronautics. American Institute of Aeronautics and Astronautics (AIAA).

Madiavale, E. M., (2016). *Effect of lean practices on operational performance of microfinance institutions in Mombasa county.* Unpublished Master's Thesis, University of Nairobi.

Magutu, P. O., Nyamwange, S. O., & Kaptoge, G. K. (2010). Business process reengineering for competitive advantage: Key factors that may lead to the success or failure of the BPR Implementation. African Journal of Business and Management (IJMP), 1 (3).

Manville, G., Greatbanks, R., Krishnasamy, R., & Parker, D. W., (2012). Critical success factors for lean six sigma programmes: A view from middle management. *International Journal of Quality & Reliability Management 29(1), pp. 7–20.*

Mason-Jones, R., & Towill, D. (1999). Total cycle time compression and the agile supply chain. *International Journal of Production Economics, 62(1/2), 61– 73.*

McKinsey & Company (2016). *Lean IT; Business technology.* http://www.mckinsey.com/businessfunctions/business-technology/how-we-help-clients/lean-it.

McLachlin, R., (1997). Management initiatives and just-in-time manufacturing. *Journal of Operations Management, Vol. 15, No. 4, pp.271–292.*

Messa, S. & Testa, S. (2004). Innovation or imitation? Benchmarking: A knowledge management process to innovate services. *Benchmarking: An International Journal, 11(6): 610-620.*

Moschella, D. C., (1997). *Waves of power: Dynamics of global technology leadership.* New York: AMACOM.

Moyano-Fuentes, J., Martínez-Jurado, P., Maqueira, J. M., & Bruque, C. S., (2012). Impact of use of information technology on lean production adoption: evidence from the automotive industry. *Notebooks of Economy and Management of the Company,15 (3) pp 105-116.*

Mugenda, O. M., & Mugenda, A. G., (2013). *Social science.* Applied Research & Training Services, Nairobi Kenya.

Mwachari, G. M., (2018). *Lean management practices and operational performance of commercial banks in Kenya.* Unpublished Masters Thesis, University of Nairobi, School of Business.

Narasimhan, R., Swink, M., & Kim, S. W., (2006). Disentangling leanness and agility: an empirical investigation. *Journal of Operations Management, Vol. 24, No. 5, pp.440–457.*

Orzen, M. A., & Paider, T. A., (2015). *The Lean IT field guide: A roadmap for your transformation.* Boca Raton, FL: Taylor & Francis.

Plessis, M.D. (2007). The role of knowledge management in innovation. *Journal of Knowledge Management, 11(4):20-29.*

Pollock, N., (2002). *Knowledge management and information technology (know-IT encyclopedia).* Fort Belvoir, Virginia: Defense Acquisition University Press.

Pyke, D. F., & Cohen, M. A. (1990). Push and pull in manufacturing and distribution systems. *Journal of Operations Management, 9(1), 24–43.*

Rahrovani, Y., & Pinsonneault, A. (2012). *On the business value of information technology: A theory of slack resource.* In Information Systems Theory: Explaining and Predicting Our Digital Society, Vol. 1, K. Y. Dwivedi, R. M. Wade and L. S. Schneberger (eds.), New York, NY: Springer New York, pp. 165–198.

Richardson, J. T. E., (1999). The concepts and methods of phenomenographic research. *Review of Educational Research, 69 (1), 53-82.*

Riezebos, J., Klingenberg, W., & Hicks, C., (2009). Lean production and information technology: Connection or contradiction? *Computers in Industry, Vol. 60, No. 4, pp.237–247.*

Rocco, T., & Plakhotnik, M., (2009) Literature Reviews, Conceptual Frameworks and Theoretical Frameworks: Terms, Functions and Distinctions. *Human Resource Development Review* 8(1), 120-130.

SAP., (2007). Technology and lean enterprise; building an infrastructure that drives. Retrieved 05 22, 2009, from Sap Web Site: download.sap.com/download.epd?context

Schlie, T., & Goldhar, J. (1995). Advanced manufacturing and new directions for competitive strategy. *Journal of Business Research, 33(2), 103–114.*

Sekaran, U., (2003). *Research methods for business (4th ed.).* Hoboken, NJ: John Wiley & Sons.

Shah, R., & Ward, P. T., (2003). Lean manufacturing: Context, practice bundles and performance. *Journal of Operations Management, Vol. 21, No. 2, pp.129–149.*

Shah, R., & Ward, P. T., (2007). Defining and developing measures of lean production. *Journal of Operations Management.*

Shankar, R., Singh, M. D., Narain, R., & Agarwal, A. (2003). An interpretive structural modeling of knowledge management in engineering industries. *Journal of Advances in Management Research,* 1: 28-40.

Sison, R,. (2006). *Knowledge management: Concepts, techniques & cases.* Emerging Technologies for Philippines 2020 (pp. 10-19), Manila: De La Salle University.

Small, M. (1999). Assessing manufacturing performance: An advanced manufacturing technology portfolio perspective. *Industrial Management and Data Systems, 99(6), 256–267.*

Staats, B. R., Brunner, D. J., & Upton, D. M., (2011). Lean principles, learning, and knowledge work: Evidence from a software services provider. *Journal of Operations Management 29(5), pp. 376–390.*

Stone, K. B., (2012). Four decades of lean: A systematic literature review. *International Journal of Lean Six Sigma 3(2), pp. 112–132.*

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly, 28(1), 45–73.*

The Boston Consulting Group, (2012). *Transforming IT with Lean.* https://www.bcgperspectives.com/content/interviews/it_transformation_it_performance_transforming_it_with_lean/.

Thompson, M. P. A., & Walsham, G., (2004). Placing knowledge management in context. *Journal of Management Studies, 41*(5), 725–747.

Tushman, M., & Nadler, D. (1978). Information processing as an integrating concept in organizational design. *Academy of Management Review, 3(3), 613–624.*

Valencia-Go, J., (2015). *Basics of qualitative research: Grounded theory procedures and techniques.* Sage Publications; Newbury Park, CA.

Wafukho, F.M., (2011). *Effectiveness of lean six sigma on continuous improvement at GlaxoSmithKline.* Unpublished Master's thesis, University of Nairobi.

Wamalwa M. S., Onkware K., & Musiega., (2014). Effects of lean manufacturing technology strategy implementation on factory time efficiency; A case study of Mumias sugar company limited in Kakamega County, Kenya. *International Journal of Business and Management Invention, 3*(5).

Ward, P., & Zhou, H., (2006). Impact of information technology integration and lean/just-in-time practices on lead-time performance. *Decision Sciences, Vol. 37, No. 2, pp.177–201.*

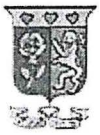
Womack, J. P., Jones, D.T., & Ross, D., (1990). *The Machine that changed the world.* MacMillan/Rawson Associates, New York.

Womack, J., & Jones, D. (1996). *Lean thinking: Banish waste and create wealth in your corporation.* New York: Simon & Schuster.

Yala, J. O., (2016). *Lean management supply chain and operational performance of manufacturing firms in Kenya.* Unpublished Master's thesis, University of Nairobi.

APPENDICES

Appendix I: Introduction Letter



Strathmore University
Business School

Effect of Information Technology Integration on Lean Production: A Case of Nestle' Kenya

The Respondent

Dear Sir/Madam

Re: Request for Research Data

My name is Susan Mbula, a Master of Business Administration student at Strathmore University. In partial fulfillment of the master's degree programme, I am required to carry out a research project and write a dissertation on a contemporary subject within my field of specialization. Among other activities, the project involves data collection and analysis. I hereby request to gather information to be used in this research in your firm. The information obtained will be used for this academic purpose only and will be kept confidential. The results of the survey will not disclose any individual, company name or information in any way.

If you have any further questions about this study, you may contact me directly via my email address, Susan.Mbula@ke.nestle.com

Thank you very much for your time and cooperation.

Sincerely, Susan Mbula

Appendix II: Research Questionnaire

This questionnaire is structured to collect information on the effect of Information Technology on Lean Production implementation. Kindly read the questions carefully and tick against the asked question as per your position or understanding and relevance to the study. Utmost confidentiality is assured as the data collected from this questionnaire will purely be used for academic purposes.

PART A: BACKGROUND INFORMATION

1. Job Position

Top level management ( ) Middle level Management ( ) Junior staff ( )

2. Which division do you work in? Supply Chain ( ) Finance ( ) Manufacturing/Operations ( ) Commercial ( )

Any other (Specify) .....

3. Gender: Male ( ) Female ( )

4. Age: 20- 29 ( ) 30– 39 ( ) 40 – 49 ( ) 50 and above ( )

5. Highest education level: Secondary ( ) Diploma ( ) Bachelor Degree ( ) Postgraduate ( )

6. What are your terms of employment? Permanent ( ) Contract ( )

7. Working experience with the current employer: -

5 and below ( ) 6 – 10 ( ) 11 – 15 ( ) 16 – 20 ( ) 21 and above ( )

PART B: IT INTEGRATION

KNOWLEDGE MANAGEMENT

8. Kindly indicate the extent to which you agree with each of the statements by using the following scale:

Use 1 – Very Low Extent, 2 - Low Extent, 3 – Moderate Extent 4 – High Extent, 5- Very High Extent

Statement	1	2	3	4	5
I consider Nestle Kenya as a knowledge-based firm, it efficiently handles information resources					
Nestle Kenya recognizes information resources as a part of its asset base.					
Nestle Kenya's senior management have a positive attitude towards knowledge management.					
Nestle Kenya provides knowledge-management training for new technologies.					
Nestle Kenya utilizes internet and intra-net channels to obtain information.					

INTERNAL IT INTEGRATION

10. Kindly indicate the extent to which you agree with each of the statements by using the following scale:

Use 1 – Very Low Extent, 2 - Low Extent, 3 – Moderate Extent 4 – High Extent, 5- Very High Extent

Statement	1	2	3	4	5
Nestle engages IT in human resource management					
Nestle engages IT in customer credit procedures					
Nestle engages IT in product development and research					
Nestle engages IT in risk management					
Nestle utilizes ERP systems					

EXTERNAL IT INTEGRATION

11. Kindly indicate the extent to which you agree with each of the statements by using the following scale:

Use 1 – Very Low Extent, 2 - Low Extent, 3 – Moderate Extent 4 – High Extent, 5- Very High Extent

Statement	1	2	3	4	5
Nestle engages IT in customer relationship management					
Nestle engages IT in marketing processes					
Nestle lead-time in a supply chain is divided into electronic ordering information lead-time and physical material movement lead-time.					
Nestle shares demand and inventory data with suppliers/distributers to shorten the order processing lead time					
Nestle utilizes IT systems in the procurement process to select the most appropriate supplier					

PART C: LEAN PRODUCTION

14. Kindly indicate the extent to which you agree with each of the statements by using the following scale:

Use 1 – Very Low Extent, 2 - Low Extent, 3 – Moderate Extent 4 – High Extent, 5- Very High Extent

Statement	1	2	3	4	5
Nestle Kenya implements a manufacturing system in which materials or components are delivered immediately before they are required in order to minimize storage costs.					
Nestle Kenya implements a manufacturing system where the time it takes to complete equipment changeovers is drastically reduced.					
Nestle Kenya has a visual workflow management system.					
Nestle Kenya implements a self-directed maintenance system, where machine operators are responsible for the routine maintenance and operations of their machines and equipment.					
Nestle Kenya has a system of continual process of detecting and reducing or eliminating errors and wastages in production.					

Thank you for your co-operation

Appendix III: Budget

Items	Details	Cost
Stationery	Printing papers	2,000
	Binders	1,000
Transport		2,000
Data collection	Internet	2,000
	Distribution of instruments	2,000
	Collection of instruments	2,000
Production of the documents	Typesetting	1000
	Printing	2000
	Photocopying	1000
	Binding	1000
Data analysis		30,000
TOTAL		**46,000**

Appendix IV: Work plan

Activities	**Start Time (2020)**						
	Jan	Feb	March	April	May	June	July
Proposal writing							
Proposal defense and corrections							
Data collection							
Data analysis							
Report writing							
Submission of Research Report							