LEAN, AGILE AND LEAGILE MANUFACTURING AS ANTECEDENTS TO PLANT PERFORMANCE OF MANUFACTURING FIRMS IN DEVELOPING COUNTRIES: EMPIRICAL EVIDENCE FROM UGANDA

By

Nickson Nagaaba

Supervisors

Dr. Theresa Moyo

Dr Dan Ayebale

A PhD Proposal submitted in fulfilment of the requirements for the award of Doctor of Philosophy in Business Administration of

Mbarara University of Science and Technology

December, 2016

Declaration

I Nickson Nagaaba declare that this proposal is my original work.

Signature …….

Approval

This proposal has been submitted under the approval of two supervisors

Prof. Theresa Moyo Signature ……

Dr. Dan Ayebale Signature ……

Table of Contents

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This study seeks to examine the interaction of manufacturing paradigms of lean, agile and their combination (leagile manufacturing) with plant performance of firms in developing countries. This is topic that has been debated in a number of previous studies (Arnab , 2012; Mattias & Jan , 2009; Helio, Goran, & Vaibhav, 2012; Thaeir, 2014; Rajesh & Charlene , 2007). Most of the contribution made in these previous works has majorly focused on experiences of firms in developed countries and more recently in key emerging economies such as those in Asia, USA and Netherlands. In this study, the focus is of a unique context of developing country firms in Africa and specifically Uganda. The study addresses the role of three major manufacturing practices: Agility and lean, and their hybrid; leagile manufacturing in battle to improve plant performance. The subsections that follows presents the background of the study, statement of the problem, objectives, research questions and hypothesis, conceptual framework, justification, significance and scope of the study

1.2 Background of the study

lean and agile manufacturing and their role in fostering plant performance has been of global interest (Aggrey, Eliab, & Joseph, 2010; Lynn, 2009; Xenophon, Mark, & William, 1997; Womack & Jones, 2003; Lynn, 2009; Keitany & Riwo-Abudho, 2014). Hitherto, scholars have offered vast debates on the contribution of these paradigms in manufacturing context. Strategic manufacturers have iterated many manufacturing strategies while assessing their performance among which include lean, agile and leagile manufacturing. Proponent of lean, construes lean as "to get the right things to the right place at the right time, the first time, while minimizing waste and being open to change" (Anabela, Jose, Rui, & Sousa, 2012; Bhasin, 2015; Carlo, 2015; Womack & Jones, 2003).

On the other hand, agile manufacturing focuses of flexibility in response to demand variability (Helio, Goran, & Vaibhav, 2012; Ramasesh, Kulkarni, & Jayakumar, 2001). Intensifying global competition, has forced many firms in manufacturing business to continuously look for the best practices whose basic orientation is in greater performance. Forward thinking manufacturing firms in developed countries for example, have shifted from ancient manufacturing methods to modern manufacturing practices to address plant performance related problem (Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003). Major concerns include how to maximize profit by reducing costs of processing, improve return on investment, minimize manufacturing lead time and growth (Qiang, Mark, Rogu, & Nathan, 2010; Anabela, Jose, Rui, & Sousa, 2012; Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003; Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003).

With the unprecedented competition, firms in countries like USA, India and Asia try to squeeze production time to meet customer demand and do so in the most flexible manner (Koufteros, Vonderembse, & Doll, 1998; Abraham, Mark, Subba, & Ragu-Nathanb, 2006). Amidst this competitive background, manufacturers have devised strategies of lean, agility and their hybrid of leagility as a rich tool box that augurs well their firms into higher performance on different platforms (Gerwin, 1993; Krishan & Gunasekaran, 2005; Abraham, Mark, Subba, & Ragu-Nathanb, 2006; Blackstone, Cox, & Cox, 2005; Noah, Donatus, Suzan, & Cathy, 2014; Rajesh & Charlene, 2007).

A series of research works have contributed on application and adaptation of lean and agile manufacturing paradigms in the manufacturing context especially in developed countries (Koufteros, Vonderembse, & Doll, 1998; Qiang, Mark, Rogu, & Nathan, 2010; Stalk & H out, 1990; Abraham, Mark, Subba, & Ragu-Nathanb, 2006). Research advances exploring lean and agility in countries like USA and Netherlands disclose application domains of both paradigms and show how they co-exist in the same manufacturing system. Other studies have stablished leagile manufacturing as a hybrid of the

two paradigms to eliminates all possible impediments attributed to each (Agarwal, Shankar, & Tiwari, 2006; Naylor, Naim, & Berry, 1999; Rajesh & Charlene, 2007).

Although these paradigms are linked to performance of firms, their role is rarely considered in African countries context. The few existing research reports relating these manufacturing variants and performance have even produced conflicting knowledge strands. For example, investigations made in Kenya, show no clear benefit attributed to lean manufacturing systems (Keitany & Riwo-Abudho, 2014). Scholars that investigated internal and external driver that guide the choice of lean and agile operation capabilities emphasis significant and stable resource base as a requirement for successful implementation of lean and agile manufacturing (Mattias & Jan , 2009). In East Africa, the debate is; whether or not these resources have restrained most firms from adopting these new manufacturing trends (Aggrey, Eliab, & Joseph, 2010).

Nevertheless, Uganda's manufacturing sector is propelled by better resource base, therefore close attention is paid to lean, agile and leagile manufacturing. The burgeoning oil sub-sectors, a young and expanding population, and technology initiatives are among factors that nurture and stimulate the use and adoptability of these practices (African Development Bank Group, 2014). Consequently, research on the effect of these "new wave strategies" of manufacturing has been scant and limited to profitability. Proliferated research in the manufacturing fields of Uganda indicate a positive correlation of lean manufacturing and profitability levels up to 41.4% (Noah, Donatus, Suzan, & Cathy, 2014). But then, why is plant performance of most manufacturing firms in Uganda in fraught state? (World Bank, 2011). This is an issue that has been raised by many players in manufacturing sector, especially those concerned with methods believed to hoist plant performance levels. On several occasions, such issues have been addressed by supportive initiatives in Uganda responsible for harnessing performance of manufacturing firms (African Development Bank Group, 2014; Thomas & Anne, 2013; Sulait, Satrine, & Nixon, 2014; Temesgen, 2014). In other instances, critical concern is what impedes optimal

utilization of firms capacity, plaguing Ugandan firms and even so; make them lag below the performance standard (Technoserve, 2008; Balikowa, 2011).

Against this firms' performance background, many firms in Uganda have started re-orienting their distinctive competencies calling for the appropriate and modern manufacturing strategies to improve their performance. Growing global debates among scholarly communities on the contribution of lean, agile and leagile manufacturing practices is the spring board for examining this fuzzy notion in Ugandan context.

1.3 Statement of the problem

Manufacturing firms in Uganda have for long been battling with poor plant performance. This has left the manufacturing sector noncompetitive with a revealed comparative advantage (RCA) index of less than one (African Development Bank Group, 2014). Not only that, some manufacturing firms operate under capacity with over 55 percent un utilized (DDA, 2009). The equipment utilization, untrained personnel, maintenance and waste management are some of the challenges impeding firms' performance. This has been mostly sighted among food and beverages processing firms (David B. , 2011).

Numerous investigations and theoretical propositions in manufacturing have spawned a number of manufacturing approaches to rest this appalling situation. It is from this standpoint that contenders of modern manufacturing practices point to lean, agile and leagile manufacturing. Despite these developments, empirical research explanation on the experience of manufacturing firms in Africa highlight little or dearth benefit of these practices because of their inherent costs (Keitany & Riwo-Abudho, 2014; Haron & Arul, 2012). Therefore, this study is motivated by growing importance of these manufacturing approaches and the gaps between existing theoretical propositions and empirical reality. Particularly, it seeks to explore the impact of lean, agile and leagile manufacturing practices on plant performance of firms in Uganda.

1.4 Objective of the study

This study seeks to examine the effect of lean, agile and leagile manufacturing practices on plant performance of manufacturing firms in developing countries using Uganda as a representative country.

1.5 Specific objectives of the study

Literature survey followed by its detailed examination and analysis helped identify the following research directions. There are three specific objectives of the research:

- Investigating the effect agile manufacturing on plant performance of firms in Uganda
- Investigating the effect of lean manufacturing on plant performance of firms in Uganda
- Practical approach to achieve greater plant performance through adaptation of leagile manufacturing (A combination of lean and agile manufacturing) from a Ugandan perspective.

1.5.1 Research questions

To empirically address the above issues, the interest of this study is to provide answers to the following questions.

- To what extent does agile manufacturing practice affect plant performance of firms in Uganda
- To what extent does lean manufacturing affect plant performance of firms in Uganda?
- To what extent does leagile manufacturing (a combination of lean and agile manufacturing) affect plant performance of firms in Uganda?

1.6 Hypotheses of the Study

The following hypotheses of this study have been developed based on the theoretical propositions and other empirical research findings. These hypotheses are fourfold.

- $H1_a$: Agile manufacturing directly and positively affects plant performance of firms in Uganda.

- $H1_{b.}$: Lean manufacturing directly and positively affects plant performance of manufacturing firms in Uganda.
- $H1_{c.}$: leagile manufacturing significantly affects plant performance of firms in Uganda.

1.6 Significance of the Study

The significance of this study is appreciated in three folds. First, by unveiling facets lean, agile and leagile manufacturing practices in a context of developing country like Uganda, will inform about the conventional milestones in enhancing plant performance in a rarely studied context. Secondly, from strategic point of view empirical evidences about the cause-effect relationship of variables under this study, will guide manufacturing firms on how to be creative and flexible while facing ever-changing customer requirements. Finally, understanding the how the lean and agile manufacturing coexist, provides insight into appropriateness of their fit at different points on manufacturing in different industries.

1.7 Justification of the study

This study is intended to bridge the widening gap between theoretical literature and the reality. It attempts to examine knowledge related aspects in two ways. Firstly, although some scholars believe these practices provide little impetus for stimulating performance of plant, others credit them for sustaining competitiveness in manufacturing business (Haron & Arul, 2012). These conflicting ideas in regard to antecedents of plant performance in developing countries have left a number of questions unanswered mostly in African context.

Secondly, knowledge about of lean, agile and leagile manufacturing in context of developing countries is still scant, especially in their application domains. Clearly this justifies why empirical evidences should be uncovered to beef the conventional thinking about the contribution of these practices.

1.8 Scope of the study

1.8.1 Study scope

The study will examine the extent to which lean, agile and leagile manufacturing influence plant performance of manufacturing firms in developing countries. The theoretical propositions have been central in characterizing agile manufacturing, lean manufacturing and leagile manufacturing (Eliyahu, 1984; Teece, 2000). To avoid the effect of either agile or lean manufacturing, leagile manufacturing is characterized by transshipment, trimming and postponement (Thaeir, 2014). Although previous empirical research studies provide a myriad of reflective items to measure performance, this study will concentrate on unique performance domain of plant. This will be characterized by sales growth, return on investment, market share gain, manufacturing lead time and overall competitive position to reflect broader picture of plant performance (Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003).

1.8.2 Geographical scope

This study will concentrate on the manufacturing firms in Uganda. Uganda is one of the Africa's developing country with a number of institutions to support manufacturing sector besides having a breadth of resource base. In addition, firms in Uganda operate under highly competitive environment with a vast number of foreign actors (UBOS, 2015). This has forced manufacturers in the country to continuously seek for new strategies if they are to remain competitive. Therefore, selecting Uganda for this study will provide sufficient representative data on which inference can be drawn to generalized conventional knowledge about developing countries. In order to have manageable research exercise, the study will concentrate on firms in Kampala which has majority of manufacturing firms in Uganda (African Development Bank Group, 2014).

1.8.3 Time scope

The research study will concentrate on manufacturing firms that have been in operation since 2013. Since that time, manufacturing business has been under intense adaptive pressure with rapid technological changes, competitive pressure at the firm level to shorten the production time. In addition, it is from 2013, when new materials and advanced manufacturing techniques started emerging, posing intense pressure on manufacturers to search for best practices (African Development Bank Group, 2014). Since then, global value chains have driven reorganization of production, creating new opportunities and competitive challenges worldwide. Amidst these advances, some performance of manufacturing firms in Uganda has remained questionable despite government incentives to promote manufacturing investments (African Development Bank Group, 2014).

1.9 Operational definitions

Lean manufacturing is a paradigm that encourages doing more with less: less space, less raw material, less energy and in less time (Hines, 2004). The word "lean" is defined by Howell (2001) as "Give customers what they want, deliver it instantly with no waste"

Agile manufacturing is the process that promotes the need to be responsive and flexible to customer requirements quickly (Duc & Andrew, 2012). It is the physical and fiscal quickness to respond to unpredictable events (Narasimhan, Swink, & Kim, 2006). It is no longer just a matter of how well an organization can respond, but how quickly it can respond.

Competition: This is derived from the Latin term cum petitio, which denotes the concurrence of multiple requests for the same thing, which must be allotted to an owner.

Just-In-Time: The term originated from Toyota production system's pillar of automation called "Jidoka in Japanese". Ohno (1982), the originator of JIT philosophy; defines it as "having the right part at the right time, and in the right quantity, to go to assembly". This philosophy aims at eliminating all forms of waste from operational manufacturing (Pamela, Kenneth, Green, Roger, & Victor, 2010).

Manufacturing system: This is a set of operating machines, transportation element, storage facilities, computers, people and other items integrated together that are used in manufacturing (Gershwin, 1994).

Waste "muda in japanese": Anabela, Jose, Rui, & Sousa (2012) define waste as anything that does not add value in the eyes of the customer. According to Shingo (1989), waste is any activity that does not contribute to production system.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews extant literature on lean, agile and leagile manufacturing approaches and plant performance. The first part of this section presents the theoretical propositions underpinning variables under this study. The second part provides structural relationship between manufacturing practices and plant performance. The third part delineates of concepts of lean agile and leagile manufacturing from different perspectives and highlights their empirical contributions in context of manufacturing. Finally, this chapter will end with the synthesis of literature reviewed.

2.2 Theoretical review

Theories under this sub-section provides a broad spectrum from which concepts relate (Mark, Philip, & Adrian, 2016). As evident from literature, a number of theoretical advances in the area of manufacturing have been utilized to investigate the interaction of lean, agile, leagile manufacturing practices and performance of manufacturing firms. Though they are numerous, this study is limited to the dynamic capability theory, theory of constraint and theory of solving inventive problem (TRIZ). After this discussion, critical evaluation will be made to identify the theoretical gaps.

As customers assign value to new product, manufacturers get concerned with the growth in capacity and manufacturing diversity to supply a new commodity. To this end, firms struggle to revamp on product improvements; extending existing or opening up new areas of improvements in the production processes. This innovative strategy shifts resources from one point to another. As resources continually shift from one product to another, those resources that remain in the production of incumbent product become less suitable for production of new product. Therefore, producing the next unit of new product

will cause substantial loss in old product (Metcalfe, 2001). To sustain sustainable improvement, firms have to remain on the contour of continuous improvement. Therefore, manufacturers' behaviour will tend to accumulate and concentrate on internal resource available (Cohen, 1990).

It is from this spectrum that the theory of constraint cited in the landmark book "the goal" of Eliyahu (1984), helps identifies internal resources. This theory provides the tools for optimal use of resource until they are no longer a limiting factor. One of the element of this theory is its priority on improvement activities by identifying what to change, what to change to and how to cause change. Considering manufacturing process with multiple linked activities and resources, one of which acts as a constraint upon the entire system, theory of constraint means identifying and managing these constraints into: On-time in-full (OTIF) delivery to customers, elimination of stock-outs across the supply chain, better control over operations, reduced cycle times and therefore inventories, rapid response culture and fewer chronic conflicts between team members (Eliyahu, 1984). In manufacturing domain, Kennedy & Huntzinger (2005) construe such operations as precursors of value stream management. Critiques raised by Maskell & Baggaley (2004) spell value stream management as a vice that can be implemented at maturity stage of lean manufacturing whether bottlenecks are significantly identified. To cum the alarm, the theory of constraint further establishes the framework that exposes non-value adding activities using visual management techniques (Brady, 2014). Though the theory of constraint points on the organizational resource constraints and how they can be mitigated, it tends to realm with Just-In-Time principles which manifests in mass customization (Maskell & Baggaley, 2004).

In a wider exploration on antecedents of plant performance, the theory of dynamic capabilities also provides an extension on how these resources can be identified, selected and exploited from the external perspective (Gary, 2015; Teece, 2000). This theory informs manufacturers on how to compete in technology, operations and other organizational capabilities that create advantage in product markets

(Gary, 2015). According to Teece (2000), "a firm possesses a repertoire of capabilities, the choices lies between deepening their existing capabilities and broadening them. It is from this facet, theory of dynamic capability presses firms to quickly involve employees in strategy building, integrate customers in strategic asset development, and involve suppliers and distributors in transforming these strategic assets into customer value (Teece, 2000).

The theory of dynamic capability and theory of constraint blend complementary approaches of lean and agile manufacturing to response to base and surge demand. The question here is: at what point of production will the two paradigms be operational? This means that firms must augurs themselves well, for lean manufacturing and agile manufacturing for synergetic results (Thaeir, 2014). However, the challenge of leanness and agility proliferates into manufacturing when two variants operate at different points in manufacturing system. For this reason, Mason-Jones, Naylor, & Towill (2000) proposes leagile model whose key element is decoupling point that separates agile processes from lean processes. This requires determination of the position of a decoupling point such that the burden is rightfully divided across the participants in the manufacturing supply chain. This decoupling point helps to identify the buffer stock and it repositions in respect to variability in demand and product mix. This positioning of the decoupling point is associated with postponement, the principle that correlates product differentiation in line with end user. When decoupling point move upstream, it makes manufacturing supply chain more agile and a more stable decoupling point makes it leaner hence reduced risk of being out of stock. To cater for uncertainties, leaving lean as the foundation, Martin (2010) evangelizes the combination of lean and agile paradigms into leagility.

Although other epistemological thinking blend lean and agility with some commonality, especially in domains of adaptability and flexibility, Martin (2010) argues that leanness and agility are caught in a trade-off conflict causing considerable overlap between their characteristics. For example, agile manufacturing emphasizes increased product variety and lower fixed costs for new product while

lean orientation is imbedded in decreasing setup times and work-in-process inventory. This wraps agility, and leanness as mutually supporting manufacturing concepts.

In order to provide ideality and resonant application, TRIZ (Russian acronym for "Theory of solving inventive problems") developed by Genrich Altshuller in 1946 provides a remedy. The theory, undoubtedly identifies conflicts and resolves the contradictions based on the notion: increase benefits and reduce harms and costs (Martin, 2010). It contextualizes harm as any system output that is not a benefit and cost as all inputs to the system (Martin, 2010). As manufacturers change from one strategy to another, TRIZ provides ways to overcome psychological barriers and generates solutions to problems associated with combination of innovative inventions. Therefore, TRIZ involves a systematic analysis of a problem to be solved and provides a series of guidelines for alternatives solutions. This break-through theory, is built on the type of technology used, methods used to a solve a trade-off conflict in terms of inventory and capacity hence reliability of improvement forecast.

In conclusion, though the common plays among theory of constraint and theory of dynamic capability are mass customization and waste minimization, they complement each other. The former takes the internal perspective while the later focuses on external environment of the firm. Both Lean and agility emphasize ruthless elimination of waste in all forms in order to optimize plant performance. The former provides techniques such as value stream management, continuous improvement and visual management are identified to help eliminate waste. The objective of the later is to respond quickly to a new situation. These objectives of the agility are manifested in three perspectives: partnering agility, customer agility and operation agility (Sambamurthy, Bharadwaj, & Grower, 2015).

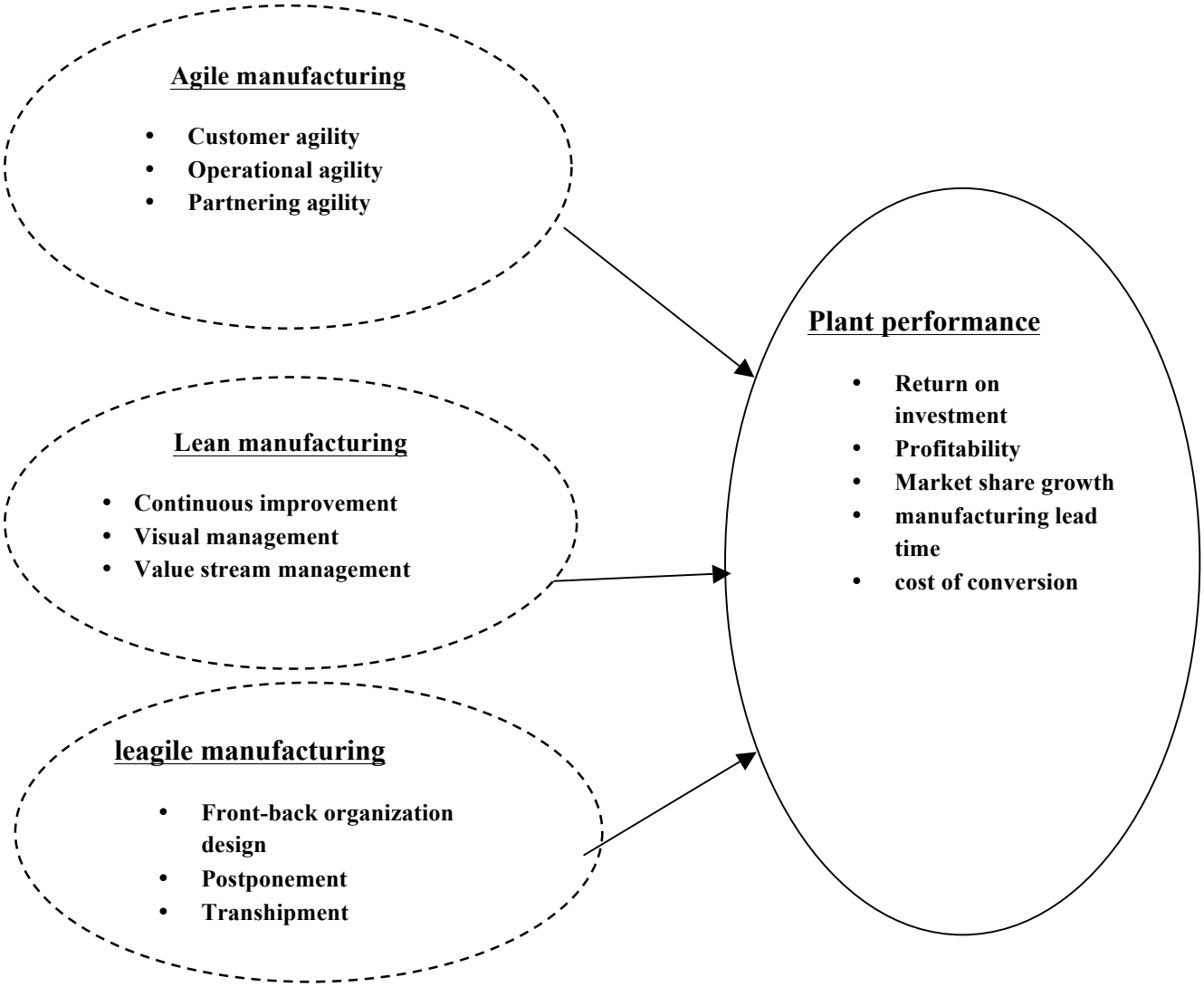
One of the useful principle within theories of constraint and dynamic capability is the notion of underlying imperative efforts to provide strategic approach to plant performance improvement (Martin, 2010). Notwithstanding that, TRIZ recognizes waste as accrued from excessive benefit, harm or cost.

This theory provides front-back organization designs, transshipment and postponement as subtle solutions to deal with problems associated with lean and agility (Martin, 2010; Rajesh & Charlene , 2007). All these theories reviewed provide basic orientation into the conceptual framework in the next section

2.3 Conceptual Framework

The conceptual frame work gives light on the hypothetical relationship between constructs of independent and dependent variable (Figure 2.1). The agile, lean and leagile manufacturing approaches are domains of plant performance function. Theories in previous subsection and empirical research studies have provided a spade of input to characterize lean, agile and leagile as input variables of the function. Based on the previous studies, plant performance measurements have been instituted as return on investment on the hand, return on investment, growth, market share growth, cost of conversion and manufacturing lead time (Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003).

Figure 2.1: Conceptual frame work



Designed by the author (Arnab , 2012; Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003; Rajesh & Charlene, 2007; Manimay, 2013; Keitany & Riwo-Abudho, 2014; Daniel, Kaus-Helmut, & Uwe, 2005)

The interaction between the variables demonstrated in conceptual framework provides the backbone of this study. However, it does not yield full understanding of the variables and their causal-effect relationship. To draw better understanding on concepts in this study, the next sub section provides

delineations of variables highlighted in the conceptual framework and the empirical studies to facilitates the theoretical propositions.

2.4. Lean manufacturing

The notion of Lean is often stated to have started with Benjamin Franklin who in 1733 began publishing "Poor Richard's Almanack"; that was written on an annual basis (Bhasin, 2015). It is when wastage was recognized as critical issue attributable to the various processes and their alignment. This concept was applied in manufacturing of vehicles in Japan (Ohno, 1988). The actual concept of "Lean" is coined in the research work of Krafcik (1988) as "International Motor Vehicle Program" part of Massachusetts Institute of Technology. With external forces taking control, lean principles concentrated upon quality and cost in the earlier years of 1990s but this extended to "customer value" in early 21st century. (Womack & Jones, 2005). In this 21st century, the escalating universal competition, has driven manufacturing firms to improve flexibility, sharpen market responsiveness, improve output and eradicate waste within the manufacturing process (Womack & Jones, 2005; Wincel & Kull, 2013). Among others, one way to improve efficiency in manufacturing is to focus on implementation of lean philosophies in manufacturing that allow proper and full use of resources (Syed, Jamil , & Memmona, 2011). It is from this knowledge that the scholarly community views principles of lean manufacturing in three fold: continuous improvement (Syed, Jamil , & Memmona, 2011; Alok, Dangayach, Mittal, Milind, & Sharma, 2011), visual management (Ronchi, Luzzini, & Spina, 2008; Voss, Sirdeshmukh, & Voss, 2008; Gwendolyn & Galsworth, 2014; Carlo, 2015) and value chain management (Rother & John, 2003) (Appendix i).

2.4.1. Continuous improvement

This is a quality philosophy that assumes further improvements are always possible and processes should be continuously re-evaluated and improved with an objective of reducing waste (Lynn, 2009). It

is an on-going effort to improve manufacturing process overtime (Appendix iv). Sulait, Satrine, & Nixon (2014) connotes that firms which invest capital through training based on employee training needs, leads to high performance and enables the firms to achieve their goals. Syed, Jamil, & Memmona (2011) also argue that performance; to a less extent, depends on the resource, techniques and programs, but more on attitude and corporate philosophies. With this orientation, identifying which activities need improvement is often difficult in most firms. Contribution to this debate made by Keitany & Riwo-Abudho (2014), indicate that continuous improvement is critical in management style at all levels for an efficient producer. Despite having very many areas that need improvement, big concern in research studies has been contribution of continuous improvement from the production floor perspective.

2.4.2 Visual management

Another principle of lean manufacturing is visual management where self-ordering, self- explaining, self-regulating and self-improving conditions are elected (Gwendolyn & Galsworth, 2014). Brady (2014) explains visual management as a lean concept that emphasizes putting critical information at the point of use. He vitalizes 5S-visual systems (Appendix v) that serves as the key sustaining force for lean initiatives. This principle ensures that the system remains clearly visible, readily understood, and consistently adhered to long after the Kaizen or rapid improvement event is over.

2.4.3 Value stream management

Value Stream Management (VSM) is a discipline for planning, linking, integrating and co-ordinating "lean" initiatives (Rother & John, 2003). This is done operationally by deploying the value stream mapping technique, that calls for systematic data collection and analysis (Carlo, 2015). The use of value stream mapping as suggested by Womack and Jones (2003) analyses both materials and information flows. Value stream mapping usually employs standard symbols to represent items and processes, therefore knowledge of these symbols is essential to correctly interpret the production system problems. Hine, Holweg, & Rich (2004) explains six sequential tools of value stream mapping as follows:

Strong commitment to lean initiatives

Top management must be fully knowledgeable and fully committed to lean. If top management delegates the lean project and leaves it in the hand of a senior manager (possibly the operations or production manager), it is likely that the project will end up into marginal and even spurious results (Crowder & Friess, 2013).

Identify the value stream

A value stream is defined as that sequence of processing activities that produce a product or range of products (or service/s, or both). A value stream begins at supplier's premises and ends at client/s' premises (Rother & John, 2003). A value stream management exercise will succeed only if those concerned in each operational area of the value stream will fully participate and actively be involved and committed in manufacturing process (Hine, Holweg, & Rich, 2004; Howell, 2001). Details of the value stream activities are highlighted in the appendix vi.

learn lean practices

This is the education and training stage, both formal and informal training. It is a well-planned lean training program that includes: awareness generation/sensitisation to identification/elimination of waste, broad presentation of the available lean disciplines and their areas of deployment and tips on how to generate and maintain the "lean momentum".

Map current state

Value streams, operational steps and processing components (both value adding and non-value adding activities) in the entire value stream process are identified and mapped on a wall-poster like story box with two main areas as shown in appendix iv (Rother & John, 2003). Schematic icons are used to identifyvalue stream processing stations starting from supplier/s and ending with client/s in the current state area. Data collected from supplier, despatches to clients and each processing station is inserted in

respective data boxes (Appendix vii). Average time regarding information and material flows is cultivated beneath each and between processing station (Hine, Holweg, & Rich, 2004).

Determine the most appropriate matrices for the top managers

The current state map is an operational tool that can be used any time by every manufacturing member. This may not be important to the top manager in evaluating performance. The matrices of indices for throughput time, downtime, uptime, inventory time, overall equipment effectiveness (Duc & Andrew, 2012) and value adding time, lean index of throughput time and other indices broadly describing the value stream are excavated from the current state of value stream map (Hine, Holweg, & Rich, 2004).

Map the future state

The future state of the value stream brings the Kaizen style of improvement (Brady, 2014). Is designed to suite the real targets in manufacturing with minimal residual waste, shortest possible throughput time, continuous flows and maximum lean index. The structure of the value stream mapping has been demonstrated has been demonstrated in appendix viii

2.5 Agile manufacturing

Agile manufacturing was envisioned in a report from Iacocca Institute at Lehigh University (USA) in 1991 (Hormozi, 1994) and (Goldman & Nagel, 1991). The design of a manufacturing system must consider the technical, physical, human and information technology that limit the ability of the system to achieve the desired goals (Koste, Malhotra, & Sharma, 2004). Different authors provide a number of philosophical connotations about agility. Abiar & Civerolo (2012) interprets agility from managerial perspective as a combination of organization, people and technology into an integrated system to meet the rapid changes in the products and services. As a contribution to this, system view of Yusuf, Sarhadi, & Gunasekaran (1999) points at how resources can be reconfigured to improve speed, flexibility,

innovation and profitability. This is in accord with organizational view of Goldman, Nagel, & Preiss (1995) that emphasize utilization of all existing resources regardless of their location with other companies by changing organizational structures under rapid reconfiguration. From the market perspective, where changes are readily unpredictable, Gunasekaran, Marri, & Yusuf (2002) and Naylor, Naim, & Berry, (1999) describe agility as capability to survive by reacting quickly and effectively to such changes. Other scholars construe agility from operational manufacturing perspectives as a facility with manufacturing nodes organized for customized production (Evan, 1991; Chowdiah, 1996; Hormozi, 1994; Ramasesh, Kulkarni, & Jayakumar, 2001; Thaeir, 2014).

On a number occasions, this manufacturing practice has been derailed by a number of factors as highlighted by Crowder & Friess (2013). Firstly, many managers may feel like they have nothing to do, given the autonomy and control that the agile team need to have over the development efforts. Individual accountability to the teams is crucial to the overall success of agile manufacturing practices. Secondly, lack of commitment of top management can be very frustrating throughout the entire effort. Top management commitment is propitious to provide the proper management training on agile manufacturing. Thirdly, just being efficient at production and being adaptable to changes doesn't mean agile manufacturing is successful, therefore agile manufacturing teams need to be trained in how to collaborate effectively and how to deal with generational, cultural, and other differences that can cause change in environment. Lastly, many practitioners feel that agile gives them the freedom to not worry about documentation and accuracy. The right amount of documentation is essential in order for the members to understand and integrate work processes. These constraints can result in conflicting trade-offs in terms of productivity, quality, efficiency and cost (Koste & Malhotra, 2000) causing laxity on principles of agile manufacturing practices. Despite these derailing facts, experiences with firms especially in developing countries show agile manufacturing principles as leading manufacturing strategies reinforcing performance.

In other instances, the two paradigms have been harmonized. To this effect, Naylor, Naim, & Berr (1999) provide robust tool of leagile initiatives. They put it clear that neither paradigm is better nor worse than the other irrespective of the intensity of competition. "It is a matter of how you concentrate on product service at the expense of cost reduction" (Naylor, Naim, & Berry, 1999). Based on perspective of total supply chain, they suggest and recommend a exclusive clamp from which lean and agility paradigms can carefully be combined to address challenges associated with either when operated in isolation.

2.6 Leagile manufacturing conceptual ideology

Unprecedented changes in the business environment and uncertainty have caused management studies to critically focus on manufacturing initiatives to cool this inflammation. When agile manufacturing is adopted to response to uncertain and changing demands, lean is also accomplished to minimize waste due inefficient operations, excessive buffering and other non-value adding activities in operations. Therefore "as agility presumes leanness, leanness might not presume agility" (Thaeir, 2014). When both tools are effectively applied, the hybrid will create a more robust response to changing demand. However, scholars warn manufacturers on how the two approaches co-exist.

Firstly, operating of lean manufacturing and agile manufacturing cause are mutually exclusive results. Therefore, they cannot be simultaneously applied at the same point in manufacturing process. As leanness operates best with a few variety of products, agility reacts to short term production requirements with high level of customised orders (Martin, 2010). Proponents of leagile philosophy of manufacturing have cited this hybrid as the most suitable tool for waste minimization and efficient production (Agarwal, Shankar, & Tiwari, 2006). Leagile philosophy blends clearly capabilities rooted in principles of both lean and agile manufacturing practices. In the context of manufacturing, this hybrid strategy uses a decoupling point principle (Mason-Jones, Naylor, & Towill, 2000). Under this principle, lean philosophy tools operate until the decoupling point is reached. It mainly focuses on cost efficiency in production system. On the other hand, agile production principle whose objectives is flexible response to demand, is applied on the other

side of the decoupling point. But then, it is important to have the decoupling point closer to the customer where lean practices forms a greater portion of the value chain.

In addition to decoupling identification, other scholars argued that leanness and agility are practices that can be caught in trade-off (Agarwal, Shankar, & Tiwari, 2006). They look at the conflict nature of dependency, inventory and capacity and systematically link such trade-off. It is on this footing that Thaeir (2014) suggests transhipment principle that naturally maintains replenishment levels across different locations in a manufacturing floor and postponement as a principle that can maintain decoupling point stable.

Secondly, leagile manufacturing approach separates base demand and surge demand by emphasising quick response to changes and uncertainties. This means that other best practices are pertinent in reinforcing leagility. Nonetheless, the basic foundation of leanness must be maintained at all level. Even then, initiatives of agility can be built on lean features. Therefore, it is impossible to acquire agility without first enhancing stages of leanness (Mason-Jones, Naylor, & Towill, 2000).

Such conflicting strands are still sailing on the manufacturing landscape. With much emphasis on the application of agility and lean, it is found necessary to examine how the leagility relate to plant performance.

2.7 Plant performance

The scholarly community has described plant performance enormously from different contexts at different level. In manufacturing context, there exists no well-grounded approach for explaining performance. Some economists contributing to this knowledge, use different perspective to describe this phenomenon. Although scholars provide varying inputs in measuring plant performance, to some degree, its estimation has remained complex (Kokkinou, 2010) because of heterogenous nature of manufacturing industry. Proponents of non-financial measures demonstrate that such measure encourage

Despite, these facets from which this phenomenon is described, the eminent theme remains probability of production advantage over competitors (Helena & Saku, 2001). To provide an understanding on these plant performance measurements, scholars have postulated varying indicators of plant performance at a work station. A few that have looked at the notion of plant performance construe this phenomenon as the speed at which the equipment runs relative to its designed speed (Aggrey, Eliab, & Joseph, 2010; Brady, 2014; Kokkinou, 2010). At production floor, plant performance is interpreted as a relationship between work in progress, throughput and cycle time (Alok, Dangayach, Mittal, Milind, & Sharma, 2011).

Since manufacturing processes are always not identical and where human component in operation also adds uncertainty, it is difficult to have unified description of plant performance. Even so, reflective indicators of plant performance must manifest the relationship with the lean and agile principles. Suddenly, scholars have provided a fleet of reflective indicators of plant performance which include: sales growth, return on investment, market share gain, manufacturing lead time and overall competitive position (Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros, 2003).

2.8 Lean and agile manufacturing as strategies to improve performance: The empirical evidence

In attempt to respond to internal and external shocks in a dynamic manufacturing enviroment, firms adopt the use of both lean and agile production systems either in isolation or in combination depending of the level and point of production. Vast research studies examining lean and agile manufacturing paradigms have pointed out a number of contributions in regard to performance. Keitany & Riwo-Abudho (2014) investigated the effect of lean production systems on product quality and the challenges attributed thereto using a descriptive research design. Their findings reveal that for lean to be implemented successfully, management styles and holistic involvement of staff are paramount. It was evident that 75% of flour manufacturing firms in Kenya, adopting lean production successfully, their

systems lead to improved performance. Despite this contribution, critiques raised here, manifest in lack of contingencies to contain demand variability, lack of human consideration and narrow operational focus on the shop-floor.

Manimay (2013) also examined lean adoption in Indian manufacturing plants and its impact on operational performance. The survey made on 400 firms in four geographic regions in India show that approximately 80 percent of the firms implemented dimensions of lean. Among these dimension, focus on customer needs, pull system, setup time reduction, total productive maintenance, supplier performance, statistical process control, and cross-departmental problem solving were frequently applied. In an attempt to investigate how these operational metrics improve productivity, some of the pointed benefits included reduced manufacturing lead time and improved first-pass correct output.

The same manufacturing paradigm was also investigated in China by Shahram (2008). Under that study, manufacturing practices related to inventory; team approach; processes; maintenance; layout suppliers; setups; quality; and scheduling and control were evaluated. The result showed that different manufacturing firms have different levels of leanness depending on the industry type. It was found out that plants that emphasize more of lean related systems gained higher performance and competitiveness than others.

On the other hand, Lucia , Esteban , & Daniel (2007) took an initiative to analyse agile manufacturing in Spain. Their investigations on 283 manufacturing firms, show that competitiveness in a turbulent environment is strengthened by integrated use of agile manufacturing practices. This further results in better operational, market and financial performance. Results from the survey show that agile practices boost manufacturing strength through quality efficiency and cost. The greatest influence of agile approach, however was noted in market performance. Their study however, was limited by single response bias and determining the unit of analysis. Among them, the empirical study report of Saeed, Hossein, & Hossam (2014) examined relationships between supplier involvement, absorptive capacity and agile product innovation companies in manufacturing sectors. They noted a positive and linear

relationship between supplier involvement and performance. Also, agility and speed were found to arise from full integration and dissemination of knowledge within the organization while maintaining its flexibility. This is a panorama of what Sambamurthy, Bharadwaj, & Grower (2015) termed as partnering agility. This supplier involvement results in adequate information dissemination platform and reduced throughput time besides enhancing quality efficiency.

However, the finding of Pamela, Kenneth, Green, Roger, & Victor (2010) using 104 US manufacturers show that agile manufacturing is not a stand-alone manufacturing strategy. Its concreteness in justified by organizational infrastructure, systems and other strategic imperatives (Vokurka, Lummus, & Krumwiede, 2007).

Other investigations were made on two paradigms of lean and agility since they have different stances from which they stimulate performance. It is from this contexts that some scholars investigated how the two can foster plant performance and efficiency better than in isolation. Shannon & Anna Bella (2012) examined both practices of agile and lean manufacturing systems. In spite of their differences, they found out that both lean and agile practices in one manufacturing system improve sustainability. Using complexity thinking approach, Marie-Joelle & Sandra (2012) also investigated lean and agile concepts. Their epistemological approach reveals that, lean and agile are inseparable and interdependent. This combination provides a rich tool box for improving competitiveness.

In the event of unprecedented competition, where firms are modelled by the internal and external drivers, effort to utilize initiatives of lean and agility were investigated in different countries. Using cross- sectional research design on 211 plants from seven countries, finding of Mattias & Jan (2009) show that lean and agile practices are used by manufacturing plant to improve operational performance, quality reliability and conformance. However, their results indicate that lean and agile manufacturing differ in terms of drivers and outcomes since they are seen providing not only different, but

contradicting results. In spite of these results, they recommend firms with intense competition to either pursue a cost leadership strategy of lean or differentiating strategy of agility.

In other instances, the two paradigms have been harmonized. To this effect, Naylor, Naim, & Berr (1999) provide robust tool of leagile initiatives. They put it clear that neither paradigm is better nor worse than the other irrespective of the intensity of competition. “It is a matter of how you concentrate on product service at the expense of cost reduction” (Naylor, Naim, & Berry, 1999). Based on perspective of total supply chain, they suggest and recommend a exclusive clamp from which lean and agility paradigms can carefully be combined to address challenges associated with either when operated in isolation.

2.9 Synthesis of the literature review

Much as there are number of theoretical advances in area of manufacturing, there are gaps between reality and theory from developing countries perspective. Literature reviewed demonstrate a number of contributions accruing from adaptation of lean, agile and leagile manufacturing (Agarwal, Shankar, & Tiwari, 2006; Anabela, Jose, Rui, & Sousa, 2012; Chen, Lee, & Fujimoto, 1997). Notwithstanding the contributions made by previous studies, there are vast number of limitations. Firstly, it is observed that most of the conceptual and empirical contributions have focused more on developing countries (Bhasin, 2015; Hormozi, 1994; Helio, Goran, & Vaibhav, 2012; Lucia , Esteban , & Daniel, 2007; Womack & Jones, 2003). A second limitation of this literature is that there are relatively few empirical studies that relate paradigms of lean agility and leagility with plant performance in the context of developing countries. Thirdly, contributions made by authors tend to treat lean manufacturing and agile manufacturing as systems. This further spells philosophical values and cultural elements. This also leaves the gap in trying to address lean and agile manufacturing at paradigmatic level as in “of what value are and how are such principles are implemented”. Lastly the literature spells 3 positions with respect to the lean and agile paradigms: those who believe that they are mutually exclusive or distinct

concepts that cannot co-exist (Agarwal, Shankar, & Tiwari, 2006) , those who believe that they are mutually supportive strategies (Naylor, Naim, & Berry, 1999; Thaeir, 2014) and those who believe that leanness must be a precursor to agility (Marie-Joelle & Sandra , 2012).

All these limitations spotted, leave room to contribute to extant literature by advancing explanations for manufacturing approaches of lean, agility and leagility in the context of Uganda. This mandates the appropriate methodological approach to draw the generalised knowledge base in this area of study. The next section therefore will put forward the tools and methods to explain the interaction of these paradigm and plant performance.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter brings out methods to be followed while exploring the effect of lean, agile and leagile manufacturing practices on plant performance in a unique context of Uganda. The first part of this chapter gives the research design tailored to nature of this study. The second part highlights the population of interest which the study intends to cover. The third part, demonstrates sampling technique and consequently, the sample size will be determined in the fourth part of the section. In order to establish the firms' characteristic associated with these practices, subsequent sections of this chapter clearly bring out data collection methods, instruments to be used and how such characteristics will be analysed and measured.

3.2 Research Design

The interaction between manufacturing practices of lean, agility and their combination (leagility) with plant performance will be examined using a cross-sectional research design. This design intends to test the theoretical propositions in a more pragmatic way. The cross-sectional research design establishes the state of affairs of manufacturing firms in Uganda while identifying the latent potentials for plant performance. Descriptive research design will be used to accurately give light on firms' behaviours that

congeal into better performance. In this way, the design is concerned with answering the questions of who, what, which, when, or how much (Cooper & Schindler, 2011). A descriptive study design will be used because it is informative. Secondly descriptions are the starting point for identifying variables and building hypothetical constructs that can be tested. Thirdly, description is the only way to study a behaviour or situation and be able to shed light on how one variable explains another when it is either physically or ethically impossible to produce it in an experiment (Mugenda, 2008).

One of the objectives of the study is explore the synergy effect of lean and agile manufacturing practices. This require keen evaluation of the relative plant performance of firms with either single practices or both. Therefore, evaluative research design will also help in assessing and comparing plant performances subject to their manufacturing practices (Mugenda, 2008).

3.3 Study Population

The study intends to concentrate on medium and large scale manufacturing firms in formal manufacturing business in Uganda. The study will critically explore manufacturing practices of firms located within Kampala region as the largest industrial hub of the country Kampala is the capital city of Uganda and its proximity to main industry hub in the country has made it more attractive to many manufacturing firms. Kampala has the biggest portion of formal manufacturing business. There are 755 firms in the region, making 40% of the total firms within Uganda (UBOS, 2015). These firms will be targeted for research inquiry. Firms will constitute units of analysis and officer within the firms constitute units of inquiry. Targeted officers include executive directors, general managers, operations manager, procurement managers, financial manager and sales managers. It is expected that these officers are well vast with manufacturing systems and practices. Therefore, they can provide unbiased information about the subject matter.

3.4 Determination of the Sample size

It is impracticable to survey the entire population, therefore generalizations about populations will be reached using sampled firms from industrial parks of Kampala. Using the sampling formula of Nassuima (2000), the study will explore sample of 89 firms at 95% level of precision. That is:

$$n = \frac{NC^2}{C^2+(N-1)e^2}$$

Where

n = is sample size required,

N= is the population size

C= coefficient of variation (0.5)

e =margin of error at 95% level of confidence (0.05)

With all probability sampling, it is important to have a sample size that is large enough to provide the necessary confidence to rely on the data collected. Therefore, in order to reduce non-response bias, from respondents, extra firms will be included to reach the required sample. As recommended by Mark, Philip, & Adrian (2016), the only way of obtaining this estimate is to use actual sample size *Na* calculated using the formula below

$$Na = \frac{n \times 100}{re\%}$$

where *N*a is the actual sample size required,

n is the minimum sample size

re % is the estimated response rate expressed as a percentage

Since an estimate of response rate from our sample to which a questionnaire will be sent is difficult, Mark, Philip, & Adrian (2016) advises to use response rate that was yielded in similar survey. Impliedly, this study will utilize the response rates of 65% of Mattias & Jan (2009). This response rate was yielded while investigating internal and external factors that drive the choice of lean and agile

operations capabilities and their respective impact on operational performance. By implication, the actual sample size for this study will be 137 manufacturing firms.

3.5 Sampling techniques and procedure

Having established a suitable sample size, the task remains with selecting the most appropriate sampling technique to obtain this representative sample. The following procedures will be undertaken.

First, manufacturing firms will be divided according to their attributes or industry (UBOS, 2015) as in the Table 3.1 below. In effect the sampling frame will also be divided into number of sub-set/strata.

Table 3.1 classification of manufacturing firms based in Kampala based on industry type

Manufacturing industry	**Total number of manufacturers**
(Strata)	**(Strata size) N_i**
Meat fish and Dairy products	23
Paper, publishing and printing	275
Soft drinks and Mineral water	99
Cement, ceramic lime and concrete	129
Metal products	60
Chemical paint and soap	66
Textiles, cloth, and footwear	80
Coffee and tea processing	23
Total (N)	**755**

Source: (UBOS, 2015; Wilberforce, 2015)

Secondly, random sample of manufacturing firms will be drawn from these strata irrespective of industrial park location using the sampling fraction (Mark, Philip, & Adrian, 2016).

> *"This approach to sampling is justified by previous research made by Manimay* (2013) *whose survey was with intent to measure the current state of lean implementation in Indian manufacturing plants. He used stratified sampling for the survey, as automotive companies (automobiles and auto ancillaries), the biggest users of lean system, and clustered them in the Western, Southern, and Northern regions of India from which he made simple random sample".*

Since the population size N is a universal of strata have different sizes of n, every i^{th} stratus of size N_i will be sampled using a sampling fraction of N_i/N. that is, $n=N_i/N$ (Paula & Justo, 2001).

After identifying the sampling fraction, repeated sampling will be done (Damodar, 2004) from each industrial park. Therefore, keeping the sample size fixed, and drawing several samples from each strata will reduce the biasedness within the estimate.

3.6. Data Collection Methods

Success in empirical study highly depends on the methods used to collect data and in-depth understanding of respondents about the issue under investigation (Qiang, Mark, Rogu, & Nathan, 2010). In order to cover domain of independent variable, key informants will be interviewed to identify all firm's characteristics that pertinent to lean, agility and leagile manufacturing practices. This will also help to generate additional items (Xenophon, Mark, & William, 1997). On the other hand, basic information concerning growth, return on investment, manufacturing lead time, cost of conversion and market share growth will extracted from documents of the firms after negotiating with the responsible officers. Emphasis will be put on annual financial report, performance reports, administrative reports, text on the firms' website and data-bases of day to day operations (Mark, Philip, & Adrian, 2016).

3.7 Data collection instruments

In order to obtain data for empirical analysis, questionnaires will be used to collect data (Mugenda, 2008). Data related to sensitive item in the questionnaire will be obtained by first initiating indirect orientation into oral investigation focusing particular group of respondents. Evidences from firm's documents, if available will facilitate timely response to the questions in the questionnaire (Olive & Abel, 2011). To avoid bias in response, the instrument will have a cover letter high-lighting the importance and benefits of the survey to firms surveyed. The first section will provide the general guideline for participation in the survey. The second section is designed with intent to capture background information of manufacturing firm. The third section will address issues concerning reflective characteristics of lean, agile and leagile practices. The four will bring out items related to three sub-constructs of plant performance. For the interest of determining plant performance, items within this section will objectively be captured in using both primary and secondary data.

3.7.1 Pre-test, validity and reliability of questionnaire content

A pre-test will be conducted to establish sub-constructs' validity, readability and brevity. All items generated will be tested using experts from the school of business and management and operational managers of five selected manufacturing firms who will recommend to drop, keep or modify items and/or suggest new efficiency sub-dimensions. Content validity will be computed and content deleted if the coefficient is less than 0.7 (Gatewood & Field, 1994). Sub-dimensions in the instruments will be grouped according to employees' knowledge and their jurisdiction. This will determine the quality of response (Qiang, Mark, Rogu, & Nathan, 2010). Responses bias on items will be tested for their consistence and homogeneity using Chi-square homogeneity test. This test will also be made to compare results from heterogeneous firms.

Large scale items of construct and indicators will be measured on five point Likert scale with 1=not at all and 5=greatest extent. Means and standard deviations for these items will be used to assess their stability. To empirically assess the individual and composite reliabilities of the indicators (Trochim,

2007) and their positive inter-correlations factor loading and internal consistency will be measured. Since study variables share a common theme, directionality, and preconceived pattern of inter-correlation, Cronbach (1951)'s alpha i.e.

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$ [1]

will be used for measure reliability for each sub-construct of the variables investigated. Corrected item total correlation (CITC) will be used to purify the items related to lean, agile and leagile manufacturing practices. An item will be eliminated if its correlation with the corrected item total is below 0.50. Factor analysis using varimax rotation and mean substitution will be executed to assess the uni-dimensionality of plant performance scale. Multi-collinearity, will also be determined to check degree by which regressors included in the model share a common trend, that is, whether they all increase or decrease over time.

To test the discriminant validity, pair-wise LISREL measurement modelling will be used to ensure uniqueness among reflective items of lean, agile and leagile and indicators of plant performance. The correlation of each pair of measurement will be constrained to one and the Chi-square of the constrained model compared with the unconstrained model. The difference in χ^2 at $p<0.05$ will be determined.

3.8 Data collection procedure

First, a copy of the questionnaire with a cover letter describing the purpose and significance of the study will be mailed or physically served to randomly selected managers. Two weeks later, a follow-up letter will be mailed to each of the target respondents to remind them of the survey. The names of those who

[1] N is equal to the number of items, C-bar is the average inter-item covariance among the items and V-bar equals the average variance

will have responded will then be removed from the original mailing list. After another week, a second follow-up letter with a copy of the questionnaire will be sent to those who will still have not responded. Data for previous years under this study will be obtained at first glance from firm's factual documents to analyse plant performance of firms utilizing lean and agile strategies either in combination or singularly.

3.9 Data Analysis

Since the study is on multiple lantent variables, we intend to use linear structural equation modelling methodology of stata to test structural relationship and convergence effect of the independent variable constructs(Richard, 2015). After determining the mean and standard deviations of the explanatory dimensions of the manufacturing practices, partial regression coefficient will be utilized to determine the multi-variables association. A three order and two order correlation coefficients will be calculated testing their dependency association on each explanatory item of lean, agile and leagile manufacturing individually with each of the three indicators of plant performance (Gujarati, 2014)

In order to know the proportional variation of plant performance attributed to manufacturing practices jointly, a multiple coefficient of determination (R^2) will determined (Damodar, 2004).

The t-test will be used to test the hypothesis at 95% level of significance about individual partial regression coefficient on assumption that the error term is zero. This test will be used to check the co-effect of explanatory variables. To test whether plant performance is linearly related to lean, agile and leagile manufacturing jointly, a test of overall significance will be done using analysis of variance technique. However, linear relationship among explanatory variables will be determined using regression analysis.

For every set of firms in an industrial stratum, multiple regression analysis will be used. partial regression coefficient reflects the magnitude of effect of each manufacturing practice in relation to plant performance. However, this is on assumption that the explanatory variables follow linear relationship.

3.9.1 Measurements of variables

To examine the interaction among manufacturing practices and plant performance, the composite scale of manufacturing practices will be correlated to plant performance. To investigate which manufacturing practice impacts on reflective indicators of plant performance, every independent variable will be correlated with all sub-dimension of plant performance. The Likert point scale-type will be utilised to yield the above statistics. The means and standard deviations of each item will be measured to determine their distribution. The structural relationship between dependent and independent variables will also be measured using linear structural equation modelling.

References

A division of cambridge assessment. (2015). *Active learning*. Retrieved from www.cie.org.uk/events.

Abraham, N. Y., Mark, V. A., Subba, S. R., & Ragu-Nathanb, T. S. (2006). Time based manufacturing improves business performance. *oprational management*, 281–306.

Abraham, Y Nahm; Mark, A Vonderembse; Xenophon, A Koufteros. (2003). The impact of organizational structure on time based manufacturing and plant performance. *The journal of operations management, 21*, 281-306.

Adam, S. (2000). International economics. In *The standard theory of international trade* (10 ed., Vol. iv).

Adamides, E. D., & Pomonis, N. (2009). The co-evolution of product, production and supply chain decisions and the emergence of manufacturing strategy. *international journal of production economics*, 301-312.

African Development Bank Group. (2014). *Eastern Africa's manufacturing sector,promoting technology, innovation,productivity and linkage-uganda country report.* Nairobi: African Development Bank Group – Eastern Africa Regional Resource Centre (EARC).

Agarwal, A., Shankar, R., & Tiwari, M. K. (2006). Modeling the metrics of lean, agile and leagile supply chain. *European Journal of Operational Research, 173*, 211-225.

Aggrey, N., Eliab, L., & Joseph, S. (2010). Firms size and technical efficiency in East African manufacturing Firms. *Current research journal of economic theory*(ISSN 2042-485X), 69-75.

Aggrey, N., Eliab, L., & Joseph, S. (2010). Size and teachnical efficiency in East African manufaturing firms. *Current research journal of economic theory*, 69-75.

Alok, M., Dangayach, S. G., Mittal, M. L., Milind, & Sharma, K. (2011). Performance measurement in automated manufacturing. *Measuring business excellence*, 77-91.

Anabela, A. C., Jose, D.-C., Rui, & Sousa, M. (2012). Lean production as promoter of thinkers to achieve companies' agility. *The learning organization*, 219-237.

Anatan, L. (2006). Examining the moderating effect of technology on the manufacturing strategy and operational performance relationship. *Empirika*, 1-6.

Andy, F. (2009). *Discovering statistics using SPSS* (Third Edition ed.). SAGE Publication Ltd.

Annika, L., Niklas, H., & Conny, A. (2015). Participative work design in lean production: A strategy for dissolving the paradox between stardardised work and team proactivity by stimulating team learning. *Journal of workplace learning, Vol.27*, 19-33.

APRISO. (2011). *Key to improving efficiency.*

Arnab , B. (2012). Synopsis of leagile supply and demand chain in an IT enabling scenario: Engineering desertation . *Jadavpur University*.

Balikowa, D. (2011). *Review of Uganda's Dairy Industry* . TechnoServe/ East Africa Dairy Development Project.

Bateman, N. (2001). Sustainability: A guide to process improvement.

Bhasin, S. (2015). *Lean management beyond manufacturing: A holistic approach.* London: Springer international publishing .

BIATEC. (2005). Using DEA model to measure efficiency. *viii.* Ing. Kristína Vincová, Technical University Košice.

Blackburn, J. (1991). *Time based competition: The next battle ground in manufacturing.* Iwin Homewood I L.

Blackstone, J. H., Cox, J. H., & Cox, J. F. (2005). *APIC dictionary* (11th Edition ed.). Alexandria VA.

Bourgeois, L. J., & Eisenhardt, K. M. (1988). Strategic decision process in high velocity enviroment: Four cases in the microcomputer industry. *Management science*, 816-835.

Boynton, A. C., Victor, B., & Pine, B. J. (1993). New copetitive strategies: Challenges to organizations and information technology. *IBM system journal*, 40-64.

Brady. (2014). When performance matters most. In B. W. Inc, *5S/ Visual workplace hand book.* Mexico.

Braglia, M., Frosoline, M., & Zammori, F. (2009). Overall equipment effectiveness of manufacturing line. *Journal of manufacturing technology management, Vol.20*(1), 8.

Carlo, S. (2015). *lean discipline: Value stream management, Value stream mapping*. Retrieved February 22, 2016, from http://www.scodabbio.com.

Chand, G., & Shirvani, B. (2000). Implementation of TPS in cellullar manufacturing. *Journal of material processing technology, Vol.103*, 144-54.

Chen, J., Lee, C., & Fujimoto, T. (1997). Adaptation of lean production in China: The impact of Japanese management practice. *International research on the Japanese Economy*.

Chia-Yen, L., & Andrew, L. J. (2014). *Operational efficiency.* Tainan City: Institute of Manufacturing Information and Systems, National Cheng Kung University.

Chowdiah, M. P. (1996). Agile manufacturing for global competitiveness. *Souvenir of international conference on agile manufacturing*, (pp. 37-46). Bangalore.

Clever, G. E., & Carla, E. (2010). The deployment of manufacturing flexibility as a function of company strategy. *Journal of manufacturing technology management, Vol.21*.

Cohen, W. a. (1990). *"Absorptive Capacity: A New Perspective On Learning And Innovation",* (Vol. 35). Administrative Science Quarterly.

Conrad, M. M., Simon, M., Ibrahim, M. J., & Jummai, M. (2013). Leadership Style and Performance of Selected Manufacturing. *European Journal of Business and Management, 5*(13).

Cook, S. A., & Reckhow, R. A. (1979). The relative efficiency of propositional proof system. *The journal of symbolic logic, Vol.44*, 36-50.

Cooper, D. R., & Schindler, P. S. (2011). *Business research methods* (11th ed.). New York: McGraw-Hill.

Corus. (n.d.). *Business case studies*. Retrieved February 22, 2016, from http://businesscasestudies.co.uk/com.

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

Crowder, J., & Friess, S. (2013). *Sytematic engineering agile design mothodologies.* New York: Springer.

Damodar, G. N. (2004). *Basic econometrics* (Fourth Edition ed.). McGraw- Hill Companies.

Daniel, S. K., Kaus-Helmut, S., & Uwe, K. (2005). Self-management of work groups through corporate values: from theory to practice. *International journal of manpower, Vol. 26*(1), 67-79.

Daniel, V.-B., Lucia, A., & Esteban, F. (2007). Agility drivers, enablers and outcomes: Emperical test of an integrated agile manufacturing model. *International journal of operations and production management, Vol 27*, 1303-1332.

D'Aveni, R. A. (1994). *Hypercompetition:managing the dynamics of strategic maneurvering.*

David, B. (2011). *Dairy Development in Uganda: A review of Uganda's dairy industry.* Technoserve Uganda.

David, W. J. (2004). *Cost of ownership and overall equipment efficiency.* California: Wright William & inc. pleasanton.

DDA. (2009). *Hand over report by the outgoing board of directors to the incoming board.* Kampala: Dairy Development Authority.

Development, E. A. (2008). *The Dairy Value Chain in Uganda.* TechnoServe Uganda.

Development, E. A. (2008). *The Dairy Value Chain in Uganda.* Kampala: TechnoServe Uganda.

Don, R. H., & Maryanne, M. M. (2006). *Cost management: Accounting and control* (Fifth Edition ed.). Thomson South Western.

Duc, P. T., & Andrew, T. J. (2012). Fit manufacturing: A framework for sustainability. *Journal of manufacturing technology management*, 103-123.

Eliyahu, G. (1984). *Improve your production today, theory of constrain Novel.*

Emiliani, L. M. (2006). Linking leader's belief to thier behaviour and competencies. *Management decision*, 2-6.

Evan, J. S. (1991). Strategic flexibility for high technology manoeuvers: A conceptual framework. *Journal of management studies, Vol. 28*(1), 69-89.

Farrell, M. (1998). The measurement of productive efficiency. *A journal of the Royal Statistical Society*.

Foley, & Mary, J. (2013, December 5). *Microsoft does way with stack ranking*. Retrieved February 12, 2016

Frost, B. (2000). Measuring performance- using the new metrics to deploy strategy and improve performance. *Measurement international*.

Fullerton, R. R., & McWatter, C. S. (2002). The role of performance measures and incentive system in relation to the degree of JIT implementation. *Accounting organization and society, Vol. 27*, 711-135.

Gary, P. P. (2015). *A Normative Theory of Dynamic: connecting strategy, know -how and competition.* Harvard Business School.

Gatewood, R. D., & Field, H. S. (1994). *Employee selection.* Fort Worth TX: Dryden Press.

Geiger, S. W., & Markri, M. (2006). Exploration and exploitation innovation processes: The role of organizational slack in R& D intensive firms. *Journal of high technology management research, 17*(1), 97-108.

George, G. (2005). Slack resources and the performance of privately held firms. *Academy of management journal*, 661-676.

Gershwin, B. S. (1994). *Manufacturing systems engineering.* Englehood Cliffs: Prentice-Hall.

Gerwin, D. (1993). Manufacturing flexibility: A strategic perspective. *Management science, Vol. 3*, 395-410.

Ghalayini, M. A., Noble, J. S., & Crowe, C. T. (1997). An integrated dynamic performance measurement system for improving competititveness. *International journal of production economics, Vol.48*, 207-225.

Goldman, L. S., & Nagel, N. R. (1991). *21st century manufacturing enterprise strategy: An industry-led view.* Bethlehem P.A: Lacocca Institute, Lehigh University.

Goldoftas, B., Alder, P. S., & Levine, D. I. (1999). Flexibility versus efficiency? A case study of model changeovers in the Toyota Production System. *A journal of organization science*, 43-68.

Gujarati. (2014). *Basic econometrics* (Fourth ed.). The McGraw-Hill.

Gunasekaran, B. H., Marri, Y. Y., & Yusuf. (n.d.). Application of activity based costing: some case experience. *managerial auditing journal, Vol. 14*(6).

Gusman, N., Lim, T. K., & Norezam, O. (2013). Impact of lean practices on operations performance: Some evidence from indonesian manufacturing companies. *Journal of manufacturing Technology management, 24*(7), 1019-1050.

Gwendolyn, & Galsworth. (2014). *www.visual workplace.com*.

Gyampah, K., & Gargeya, V. (2001). Just-In Time manufacturing in Ghana. *Industrial management and data systems, Vol.101*(3), 106-113.

Hansen, R. C. (2005). *Overall Equipment Effectiveness.* Industrial press.

Haron, M., & Arul, C. J. (2012). Efficiency performance of manufacturing companies in Kenya: Evaluation and policies. *international journal management*, 233-242.

Helena , K., & Saku, P. (2001). *Availability performance stands for plant efficiency.* VTT Automation.

Helio, C., Goran, P. D., & Vaibhav, S. (2012). A review of agile and lean manufacturing as issues in international and national research and development programs and roadmaps:. *The learning organization, Vol.19*(3), 267-289.

Helio, C., Goran, P. D., & Vaibhav, S. (2012). A review of agile and lean manufacturing as issues in selected international and national research and development programs and roadmaps. *The learning organization, 19*(3), 267-289.

Hine, P., Holweg, M., & Rich, N. (2004). Learning to evolve: A review of contemporary lean thinking. *international journal of operation and production management, Vol. 24*(10), 994-1011.

Hines, p. (2004). *Manufacturing in London: where should development effort be focused.* London: London Development Agency.

Horfkirchner, W. (2005). A unified theory of information as transdisciplinary framework. *ICT & S Center for Advanced studies and Research.*

Hormozi, A. M. (1994). Agile manufacturing. *International conference proceedings of APICS* (pp. 216-18). San Deigo: APICS.

Howell, G. (2001). *Introducing lean construction: Reforming project management.* Lean Construction Institute.

Hsieh, Y. C., Chiu, H. C., & Hsu, Y. C. (2008). Supplier market orientation and accomodation of the customer in different relationship phases. *Industrial marketing management, Vol. 37*, 380-93.

Ing.Kristina, V. (2005). *Using DEA model to measure efficiency* (Vol. XIII). Technical University Kosice BIATEC.

Ishengoma, E. K., & Kappel, R. (2011). Business Environment and growth potential of micro and small manufacturing entreprises in Uganda, African Development review. *23*(3), 352-365.

Jeong, K. Y., & Philips, D. T. (2001). Operational efficiency and effectiveness measurement. *International journal of operations and production management, Vol. 21*(11), 1404-1416.

Jesus, H. d. (2009). *The theory of dynamic efficiency* (2nd ed.). Taylor & Francis Group.

Jonsson, P., & Lesshammar, M. (1999). Evaluation and improvement of manufacturing performance measurement system-the role of OEE. *International journal of operations and production management, Vol.19*, 58-78.

Jose, A. G.-R., Emre, M. A., & Vikas, K. (2015). Measuring lean readiness through the understanding of quality practices in the Turkish automotive supplier industry. *International journal of productivity and performance management, 64*, 1092-1112.

Kanban. (2009). *Increase team performance with a visiaul project tools.* Shore Labs.

Kaplan, R. S. (2006). The competititve advantage of management accounting. *Journal of management accounting research*, 127-135.

Karfcik, J. (1988). Triumph of the lean production system. *Sloan management review*, 41-52.

Keitany, P., & Riwo-Abudho, M. (2014, June). Effects of lean production on organizational performance. *European journal of logistics purchasing and supply chain management, Vol.2*(2), 1-14.

Kennedy, A., & Maskell, M. K. (2007). Why do we need lean accounting and how does it work. *J. corp. Account Finance*, 59-73.

Kennedy, F. A., & Huntzinger , J. (2005). Lean accounting: measuring and managing the value. *19*(5), 31-38.

Kokkinou, A. (2010). A Note on Theory of Productive Efficiency and. *European Research Studies, III*(4).

Korres, G. (2007). *Technical Change and Economic Growth: Inside to the knowledge based economy.* Avebury-Ashgate, London.

Koste, L. L., & Malhotra, K. M. (2000). Tade-offa among the elements of flexibility: A comparision from the automotive industry. *International journal of management science, Vol. 28*(6), 693-710.

Koste, L. L., Malhotra, M. K., & Sharma, S. (2004). Measuring dimensions of manufacturing flexibility. *Journal of operations management*, 171-196.

Kotler, P. (1989). From mass marketing to mass customization. *Planning review, 17*(5), 10-13.

Koufteros, X. A., Vonderembse, M. A., & Doll, W. J. (1998). Developing measure of time based manufacturing. *Journal of operation management, Vol. 16*(1), 21-41.

Krishan, M. G., & Gunasekaran, A. (2005). Costing in new enterprise enviroment: A challenge for mangerial accounting researchers and practitioners. *Managerial auditing journal, Vol.20*(4), 337-353.

Lau, S. R. (1995). Mass customization: The next industrial revolution. *Industrial management, 37*(5), 18-19.

Linker, J. K. (2004). *The Toyota way-14 management principle from worlds greatest manufacturer.* New York: McGraw- Hall.

Lucia , A., Esteban , F., & Daniel, V. B. (2007). Agility drivers, enablers and outcomes: Empirical test of an integrated agile manufacturing model. *International Journal of Operations & Production Management, 27*(12), 1303-13.

Lynn, M. (2009). Continous improvement-from incremental to monumental. *Calgary Software Quality Discussion Group.* Albetra: Calgary.

Maliah, S., Nick, N., Nik, A., & Norhayati, M. A. (2005). Is standard costing obsolete? Empirical evidence from Malaysia. *Managerial auditing journal, Vol. 20*(2), 109-124.

Manimay, G. (2013). Lean manufacturing performance in Indian manufacturing plants. *Journal of manufacturing technology management, 24*(1), 113-122.

Mans, S., & Francis, T. (2001). Can African manufacturing firms become successful exporters? *Third United Nations Conference on the Least Developed Countries*, (pp. 14-20). Brussels.

Margon, H., & Sharma, C. S. (2006). Efficiency and productivity analyses of Indonesian manufacturing industries. *Journal of Asian economics, Vol. 17*, 979-995.

Marie-Joelle , B., & Sandra , F. (2012). Lean and agile: an epistemological reflection. *The Learning Organization, 19* (3), 207 - 218.

Mark, S., Philip, L., & Adrian, T. (2016). *Research Methods for business students* (7th ed.). England: Pearson Education Limited.

Martin, A. (2010, September 19). TRIZ, Theory of Constraints and Lean.

Maskell, B. (1991). Performance measurement for world class manufacturing: A model for American companies.

Maskell, B. H., & Baggaley, B. L. (2004). *Practical Lean Accounting: A Proven System for measuring and manageing lean enterprise.* New York: Productivity press.

Mason-Jones, R., Naylor, B., & Towill, D. R. (2000). Engineering the leagile supply chain. *International journal of agile management systems, 2*(1), 54-61.

Mattias , H., & Jan , O. (2009). Lean and agile manufacturing: internal and external drivers and performance outcomes. *International Journal of Operations and production management, 29*(10), 976-999.

MBendi. (2015). *Companies and organizations linked to manufacturing in Uganda.*

McMahon. (2015). *Lean manufacturing principles and practices.* Blogmaster 301 E Ocean Blvd Suite 1200 Long Beach: Apriso Corporation Dassaults System.

Metcalfe, J. S. (2001). Industrial growth and retardation theory. *ESRC: Centre for research innovation and competition* . School of Economic -University of Manchester.

Michael, S. R., & Bruce, M. T. (2016). Rooting Out the Causes of Inefficient Product Creation. New York: Arthur D Little's technology and innovation management activities.

Micheline, G. (2007). *The impact of innovation activities on productivity and firm growth: Evidence from Bravil* . Keizer Karelplein: United Nations University- Maastrich Economic and Social Research and Training centre on Innovation and Technology.

Monden, Y. (1983). *Toyota production system: A practical approach to production management.* Norcross G A: Industrial engineers and management press.

Morios, O., Isaac, S., Julius, K., & Elia, H. (2014). *Evolution of industry in Uganda.* Nairobi: African Development Bank Group-East African Resource Centre.

Mugenda, A. (2008). Social science research: Conception, methodolgy and analysis. Kenya: Applied research and training services.

Nakajima, S. (1988). *Introduction to TPM: Total productive maintenance.* Cambridge MA: Productivity press.

Narasimhan, R., & Jayaram, J. (1998). Causal linkage in supply chain management: An exploratory study of North American manufacturing firms. *Decision Science*, 579-605.

Narasimhan, R., Swink, M., & Kim, W. S. (2006). Disentangling leanness and agility: An emperical investigation. *Journal of operations management, Vol.24*, 440-457.

Nassuima, N. D. (2000). *Survey sampling: Theory and methods.* Nairobi: Nairobi UNiversity Press.

Naylor, J. B., Naim, M. M., & Berry, D. (1999). Leagility: integrating the lean and agile manufacturing paradigm in total supply chain. *International Journal of Production economics, 62*(1-2), 107-118.

Noah, M., Donatus, R. M., Suzan, W., & Cathy, T. K. (2014). Manufacturing and profitability of manufacturing firms in Uganda. *European journal of business and management, Vol. 6*(18).

Ofe, L. I., & Chuks, M. (2014). Performance efficiency measurement in the nigerian public sector:the federal universities dilema. *mediterranean journal of social sciences, Vol.5*(20).

Ohno, T. (1982). How the Toyota production system was created. *Japanese economics studies*(ISSN 2222-2839), 83-101.

Ohno, T. (1988). *Toyota production systems- beyond large scale production.* NewYork: Productivity press.

Olive, M. O., & Abel, M. G. (2011). *Research methods: Quantitave and Qualitative Approaches.* Nairobi: Central Graphics services.

Pamela, Z. J., Kenneth, W., Green, J. R., Roger, A. D., & Victor, S. E. (2010). Relationship among market orientation,JIT,TQM and agility. *Industrial management and data systems, Vol. 110*(5), 637-658.

Paula, L. B., & Justo, P. A. (2001). *Population and sample. Sampling techniques- Management Mathematics for European Schools.* University of Seville.

Pham, D. T., Pham, P. T., & Thomas, A. (2008). Integrated production machines and system- beyond lean manufacturing. *Journal of manufacturing technology management, Vol. 19*(ISS:6), 695-711.

Pine, B. J. (1993). *Mass customization: The new frontier in business competition.* Boston M A: Harvard Business School Press.

Prado-Prado, J. C., & Garcia-Area, J. (2014). *Annals of industrial engineering 2012.* London: Springer-Verlag.

Qiang, T., Mark, A. V., Rogu, T. S., & Nathan. (2010). The impact of time based manufacturing practices on mass customization and value to customer. *Journal of operations management*.

Rajesh , K., & Charlene , A. Y. (2007). Leagile manufacturing: a proposed corporate infrastructure. *International journal of operations & production management, 27*(6), 588 - 604.

Rajesh, K., & Charlene, Y. A. (2007). Leagile manufacturing: a proposed corporate infrastructure. *International Journal of Operations & Production Management, 27* (6), 588 - 604.

Rajiv, B. D., William, W., Cooper, Lawrance, M., Seiford, Robert, T. M., & Joe, Z. (2003). Return to scale in different DEA models. *European journal of operational research*, 345-362.

Ramanath, R. (1992). *Introductory econometrics with applications.* Orlando: The Dryden Press.

Ramasesh, R., Kulkarni, S., & Jayakumar, M. (2001). Agility in manufacturing system: an exploratory modeling framework and simulation. *integrated manufacturing systems, Vol.12*, 534-548.

Richard, W. (2015, April 6). *Brief overview of equation modeling using stata's SEM*. Retrieved March 12th, 2016, from http://www3.nd.edu/rwilliam.

Robert, H. (2007). *The impact of time based accounting on manufacturing performance.* The University of Tolendo.

Ronchi, S., Luzzini, D., & Spina, G. (2008). Supply chain coordination: the problem of risk and benefit sharing. *A supply chain forum: international journal, Vol.8*(2), 54-65.

Rother, M., & John, S. (2003). *Learning to see: Value stream mapping to add value and eliminate Muda.* Lean enterprise institue.

Saeed, T. N., Hossein, S., & Hossam, I. S. (2014). A study of contigency relationship between supplier involvement, absorptive capacity and agile product innovation. *International journal of operations and production management, Vol. 34*, 65-92.

Salaheldin, S. I. (2005). JIT implementation in Egyptian manufacturing firms: some emperical evidences. *International journal of operation management, Vol. 25*(4), 354-370.

Sambamurthy, Bharadwaj, & Grower. (2015). Shaping agility through digital options reconceptualing the role of information technology in contemporary firms. *MIS quarterly, 27*, 237-263.

Samvelk. (2010). Integrated lean TQM model of sustainability development. *TQM journal, Vol. 22*, 583-599.

Saranga, H., & Phani, B. V. (2004). *The Indian pharmaceutical industry-an overview of internal efficiencies using data envelopment.* Indian Institute of Management Calcutta.

SEMI, Standard E79. (n.d.). *Standard for definition and measurement of equipment productivity*. Retrieved from www.semi.org.

Shah, R., & Ward, T. P. (2007). Defining and developing measures of lean production. *Journal of operations management, Vol. 25*(4), 785-805.

Shahram, T. (2008). Lean manufacturing performance in China: assessment of 65 manufacturing plants. *Journal of Manufacturing Technology Management, 19* (2), 217 - 234.

Shan, R., & Ward, T. P. (2007). Defining and developing measures of lean production. *Journal of operations management*, 785-805.

Shannon , F., & Anna Bella , S.-M. F. (2012). Are agile and lean manufacturing systems employing sustainability, complexity and organizational learning? *The Learning Organization, 19*(3), 238 - 247.

Shingo, S. (1989). *A study of the TPS from an industrial engineering point of view.* Cambridge MA: productivity press .

Skyttner, L. (2005). *General system theory, problems perspective* (2nd Edition ed.). Singapore: World Scientific.

Spear, S. J., & Bowen, H. K. (1999). Decoding the DNA of the Toyota production system. *Business review, Vol. 77*(5), 97-106.

Stalk, G., & Hout, T. (1990). *Computing against time* . New York: The Free Press.

Sulait, T., Satrine, N., & Nixon, K. M. (2014). Human capital Elements and thier influence on performance: Evidence from Uganda's manufacturing firms. *Global journal of management and business research, Vol. 14*(2).

Swafford, P. M., Ghosh, S., & Murthy, N. (2008). Achieving agility through IT integration and flexibility. *International journal of production economics, Vol. 116*, 288-297.

Syed, I. A., Jamil , Y., & Memmona, R. K. (2011, March). Evaluation of performance in manufacturing through productivity and quality. *African Journal of Business Management, 5*(6), 2211-2219.

Sztrik, J. (2012). *Basic Queueing Theory.* University of Debrecen, Faculty of informatics.

Technoserve, U. (2008). *The Dairy Value Chain in Uganda.* East African dairy development.

Teece, D. J. (2000). *Managing intellectual capital.* Oxford: Oxford Univeristy Press.

Temesgen, T. (2014). *East African Mnaufacturing sector, Promoting technology, innovation, productivity and linkage.* Nairobi: African Development Bank Group – Eastern Africa Regional Resource Centre (EARC).

Thaeir, A. S. (2014). Modeling lean, agile, leagile manufacturing strategies: An fuzzy analytical hierarchy process approach ready for ready made ware(clothing) in Mosul, Iraq. *International Journal of Advances in Engineering & Technology*.

Therese, A., Joiner, X., Sarah, Y. S., & Suzanne, S. (2009). The effectiveness of flexible manufacturing strategies. *The mediating role of performance measurement system*.

Thomas, M., & Anne, M. K. (2013). Growth and performance of the Ugandan Dairy sector: Elite, conflict and bergaining. *International of agriculture innovations and research, Vol.2*(3).

Timothy, S. A. (2010). The efficiency theory- manuscript.

Tompson, J. D. (1967). *Organization in action.* New York: McGraw-Hill.

UBOS. (2014). *Statistical abstract 2014.* Kampala.

UBOS. (2015). *Report on census of business establishment in Uganda 2014/15.* Kampala.

Vanny, A. D. (1976). A Stochastic Theory of ProductQuality. *The journal of political economy, 84*(3).

Vokurka, R. J., Lummus, R. R., & Krumwiede, D. (2007). Improving manufacturing flexibility: The enduring value of JIT and TQM. *Advanced management journal, 72*(1), 14-21.

Voss, G. B., Sirdeshmukh, D., & Voss, Z. G. (2008). The effect of slack resources and enviromental threats on product exploration and exploitation. *Academy of management journal, Vol. 51*(1), 147-64.

Ward, P. T., Bickford, D. J., & Leong, G. K. (1996). Configurations of manufacturing strategy: Business strategy, enviroment and structure. *A journal of management, Vol.22*, 597-626.

Wilberforce, M. (2015). *The Uganda Sugar Manufacturers' Association: Seventh Annual Report For Calendar Year 2014".* Uganda Sugar manufacturers association.

William, W. J. (2004). *cost.*

Wilson, L. (2010). *How to implement lean manufacturing* . New York: McGraw-Hill.

Wincel, J., & Kull, T. (2013). *People, process and culture.* London: Productivity press.

Womack, J. P., & Jones, D. T. (2003). *Lean thinking: banish waste and create wealth in your corpeartion.* London: Free press Business.

Womack, J., & Jones, D. (2005). *Lean solution.* London: Simon and Schuster.

World Bank. (2011). *Doing Business in the East African Community.* Washington DC.

Xenophon, A. K., Mark, A. V., & William, J. D. (1997). Developing measures of time based manufacturing. *Journal of operations and management, Vol. 16*, 21-41.

Yampolskiy, R. V., Reznik, L., Adams, M., Harlow, J., & Novikov, D. (2011). *Resource awareness in computational journal of advanced intelligence paradigms* (Vol. Vol. 3).

Yazici, H. J. (2005). Influence of flexibilities on manufacturing cells for faster delivery using simulation. *Journal of manufacturing technology management, Vol.16*, 825-841.

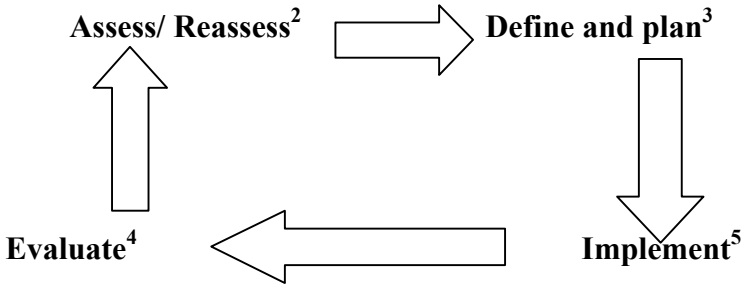
Yong , L., Shihua , M., & Li , Z. (2001). Manufacturing strategies for time based competitive advantage. *International Journal of Operations and production management, 5*(4), 407-419.

Zhixiang, C., & Kim, H. T. (2013). The impact of organization ownership structure on JIT implementation and production operations performance. *International journal of operation and production management, Vol.33*(9), 1202-1229.

Appendix i: List of constructs of study variables

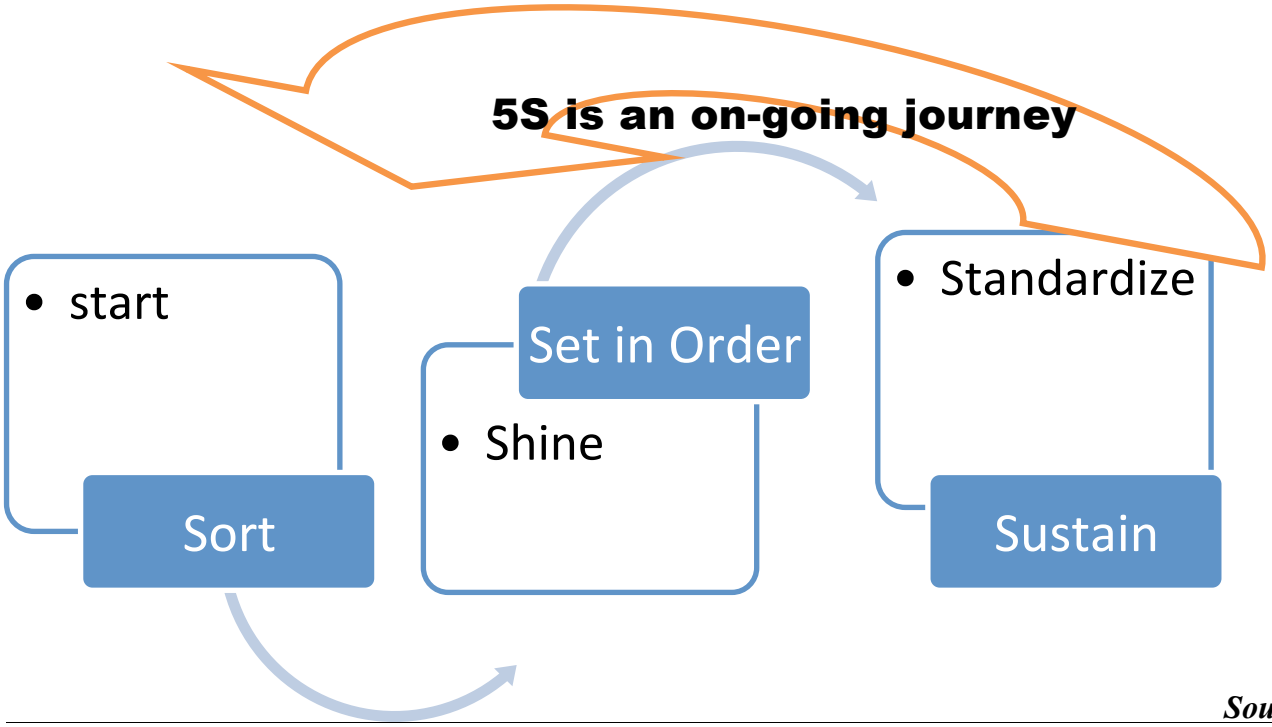
Study variables	*Operation definition*	*Reference*
Dimensions of Lean Manufacturing		
Value stream management	***Value Stream Management*** (***VSM***) is a discipline for planning, linking, integrating and co-ordinating "lean" initiatives to remove waste and create value. This is done operationally by deploying the ***Value Stream Mapping*** technique, that calls for systematic data collection and analysis	(Womack & Jones, 2003). (Rother & John, 2003)
Visual management	Visual Management provide real-time information on work place status by a combination of simple, effective visual information aids that allow employees to understand their influence on the organization overall performance hence allowing the employees to improve their performance	(Kanban, 2009) (Brady, 2014)
Continuous improvement	This is often referred to by the Japanese word 'Kaizen'. Kaizen means 'change for the better' and covers all processes in an organisation. Efforts that seek incremental improvement over time or breakthrough improvement all at once.	(Daniel, Kaus-Helmut, & Uwe, 2005) (Keitany & Riwo-Abudho, 2014) (Lynn, 2009)
Sub-construct of Agile Manufacturing		
Operational agility	Rapid redesigning of business processes and creating new processes to accomplish speed, accuracy and cost economy	(Sambamurthy, Bharadwaj, & Grower, 2015)
Customer agility	Involving customers in the exploration and exploitation of opportunities	(Sambamurthy, Bharadwaj, & Grower, 2015)
Partnering agility	Build network of strategic, extended or virtual partnerships with suppliers, distributors, etc	(Sambamurthy, Bharadwaj, & Grower, 2015)
Sub-construct of leagile manufacturing		
Front-back organization designs	"back" part of the company focuses on production of physical products and/or services. The "front" part of the organization is aimed at buying products from the back end of the company, integrates them, and delivers them to customers.	(Rajesh & Charlene, 2007)
postponement	Postponement is the delaying of operational activities in a system until customer orders are received rather than completing activities in advance and then waiting for orders.	(Rajesh & Charlene, 2007)
Transshipment	Coordinated replenishment policies across locations within the manufacturing system	(Thaeir, 2014)

Appendix ii: CONTINUOUS IMPROVEMENT LIFE CYCLE



Source: Lynn (2009)***'sPresentation at the Calgary Software Quality Discussion Group.Sept. 2009***

Appendix iii: 5S–VISUAL SYSTEM



Source:

Brady (2014)[i]

[2]Gather input on the areas of potential improvement, Survey at all levels including customers, end users, employees, consultants, competition, etc and keep in mind Kaizen is founded in the concept of dissatisfaction with the status quo, no matter how good the current state is

[3]Prioritize and keep it simple, strive to pragmatic and incremental change, ensure clarity in plan, ensure objectives are concrete and measurable and gain support from participants

[4]Frequently evaluate against initiatives' goals and objectives, engage qualitative and quantitative measures and keep the measures few and meaningful, simplistic and quantifiable

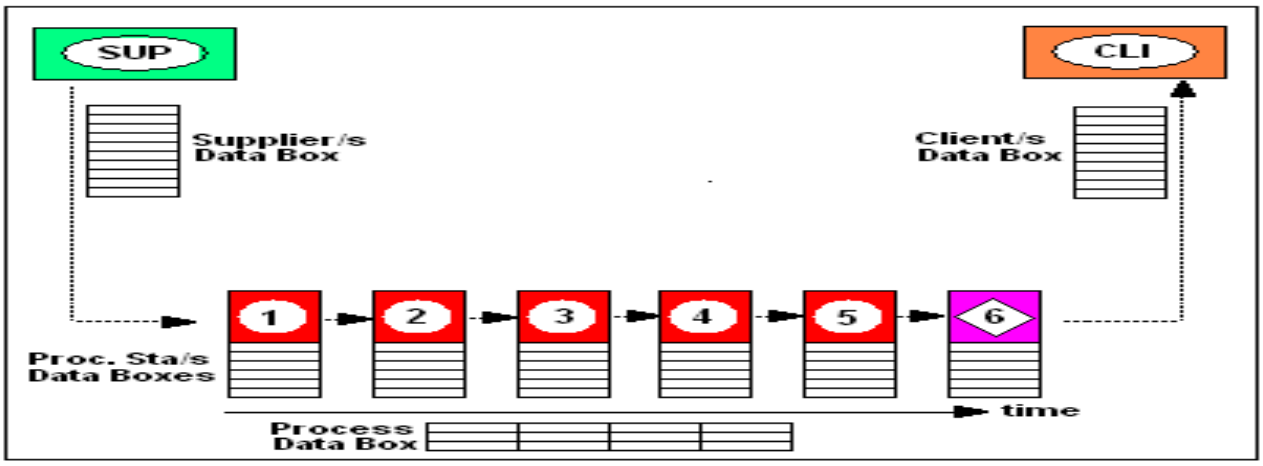
[5]Follow rollout and communication plan to share initiatives' strategy, engage the team, establish communication forum for open and constructive feedback and ensure guidance and support are available

Appendix iv: Value stream processing data

Processing station	Entire process	Supplier	Client
• Total time per shift • Planned Downtime Preventive • Maintenance Schedules • Change-Over time • Actual available daily production time • Overall Equipment Effectiveness (3 rates) • Uptime • Delivery/despatch schedules (per day/week/month) • Economic Lot size (if any) and actual Lot size • N. of items per despatch container • Cycle Time (and VA Time, if different!) • WIP • Number of operators • Typical Line/Machine speed • And any other significant parameter	• Total time per shift • Planned Downtime • Preventive Maintenance Schedules • Change-Over time • Actual available daily production time • Overall Equipment Effectiveness (3 rates) • Uptime (average) • Delivery/despatch schedules (per day/week/month • Economic Lot size (if any) and actual Lot size • Anytypical/recurring/significant disruption in the Flow • Overall number of Operators (including services and logistics) • Throughput Time (overall) • And any other significant parameter	• Descriptions and typical supplied quantities for every supplied critical material lot • Frequency of despatches (typical) • Lead time • "Punctuality" (OTDR) rate • QC on acceptance specs. • Typical rejects, non-conformities, or defective PPM (parts per million • Release to production specs (if any) - quarantine specs (if any) • Sizes of typical lots released to production • Etc.	• Customer/s requirements per product (monthly, weekly....) • Delivery/despatch actual (recorded) frequency • Delivery/despatch actual lot size (typical, average.....) • "Punctuality" (OTDR) rate • Typical rejects, non-conformities, or defective PPM actually ascertained by client/s • Etc.

Source: (Hine, Holweg, & Rich, 2004)

Appendix v: Value stream mapping



Source :(Hine, Holweg, & Rich, 2004)

Appendix vi: VALUE STREAM MAPPING

	Value stream map		
	Current state area	Future state area	
	Metrics area		

Source: Hine, Holweg, & Rich (2004)

Appendix vii : **REQUEST FOR PARTICIPATION**

Dear sir/Madam

We are writing to request for your cooperation on the study supoted by Mbarara University on important topic of time based manufacturing practices and production efficiency of manufacturing firms. The study focuses on: (1) whether agile manufacturing practices affect production efficiency of the manufacturing firms in Uganda, (2) wwhether lean manufacturing affects production efficiency of the manufacturing firms in Uganda (3) whether production efficiency is higher in manufacturing firms with agile manufacturing practices (4) whether production efficiency is higher in manufacturing firms with lean manufacturing practices. You have been selected as one of my key respondents who can provide honest and accurate information required for this research endeavour to put this debate to rest. Participation in this study will provide the following benefits to your company/firm.

Inter-firm benchmarking. The company will receive, upon request, a company benchmark report comparing efficiency in regard to time based manufacturing practices of different companies/ firms

Efficiency of companies/firms: The study will provide empirical knowledge on manufacturing efficiency of companies/firms in Uganda and shed light on importance of adopting time based manufacturing practices for competitive advantage.

Cost benefit analysis: The study will provide empirically based knowledge on the trade-offs associated with adaptation of time based manufacturing practices

Please note that the questionnaire does not require disclosure of proprietary information about the company/firm and all information provided will treated with utmost confidentiality while abiding to research ethical requirements of the University. Thank you in advance for your consideration. Do not hestate to contact either of us

Theresa Moyo, PhD	Dan Ayebale, PhD	Nagaaba Nickson
University Supervisor	University Supervisor	PhD student
Theresa.Moyo@ul.ac.za	ayebale.dan@gmail.com	nagaabanickson@gmail.com

Appendix viii: FIRST/SECOND FOLLOW-UP LETTER

Dear Sir / Madam:

About two weeks ago we sent you a letter inviting your company to participate in an online survey and physical interaction with our research team about time based manufacturing and efficiency of manufacturing firms in Uganda. The study was supported by Mbarara university of science and technology

If you have already completed and mailed the questionnaire, we would like to submit our appreciation to you for the time and cooperation rendered to us. If you have not yet responded to the survey, we would appreciate if you could spare the time to respond to the questionnaire, and submit it to us at the earliest. Your response is very important for the successful completion of this research project.

Please note that the questionnaire will not require disclosure of any proprietary information about your firm/company and all the information provide will be treated with utmost confidentiality. Also note that analysis of information provided will be done after receipt of all questionnaires. We understand that sometimes you may not have full knowledge of the exact answer, but in this case your best estimates are enough and very important. For convenience, a copy of the questionnaire has been attached. Thank you in advance for your consideration. Please do not hesitate to contact either one of us.

Sincerely,

Theresa Moyo, PhD	Dan Ayebale, PhD	Nagaaba Nickson
University Supervisor	University Supervisor	PhD Candidate
Theresa.Moyo@ul.ac.za	ayebale.dan@gmail.com	nagaabanickson@gmail.com

Appendix ix: **RESEARCH QUESTIONNAIRE**

SURVEY ON TIME BASED MANUFACTURING PRACTICES AND EFFICIENCY OF MANUFACTURING FIRMS IN UGANDA

A RESEARCH SUPPORTED BY MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY

Section one: Introduction and general guideline

This study focus on (1) finding out whether firms with time based manufacturing practices are more efficient than those without, (2) the impacts agile manufacturing on production efficiency, and (3) the impact of lean manufacturing on production fficiency. You have been selected as one of my key respondents who can provide honest and accurate information required for this research endeavour to put this debate to rest. This survey is designed to elicit responses about the current manufacturing practices that firms adopt in prevalent manufacturing environment. The data collected will be treated with strict confidentiality.

Note: request you to answer all the questions.

Section two:Background information

Thank you for your participation in this study. Please note that all data are completely confidential and will be reported only in aggregate form. We will be glad to share you the report findings upon completion.

a. Please indicate your highest level of education.....

b. Indicate the name/s of your main product.....

c. Please specify the number of employees in your firm.....

d. In which year was your firm incorporated.....

e. How many different variants/product is your firm/company currently manufacturing.....?

f. How many variants does your business firm/company have within the major product family.....?

g. How many new variants have been introduced within the major product family in last two years...?

h. How many entirely new products have been introduced during the last two years.....

i. How do you describe the stage of development of the major product manufactured and sold by your firm? (Choose among the options below and tick)

Introductory stage	**Tick**
Growth stage (Primary demand just starting to grow)	
Macurity stage (Demand growing at 10% or more annually)	
Decline stage (Product familiar to vast majority)	
Assembly lines (Product viewed as a commodity, weaker competitors start to exit)	

j. Which types of operation does your firms use (tick the appropriate)

Operation type	**Tick**
Continuous process	
Batch processing	
Flexible manufacturing	
Assembly lines	

Section three: Agility

This section addresses the level of agility of the firm operations. Using the scale provided indicate the extent to which you agree with the following statements with regard to your company. 1= strongly disagree and 5 = strongly agree

Items of agile manufacturing	**Strongly disagree 1**	**Disagree 2**	**Moderate 3**	**Agree 4**	**Strongly agree 5**
Our equipment is designed to produce variant products quickly					
Our products are classified into groups with similar processing requirements					
Our products are classified into groups with similar routing requirements					
In our firms the plant can be set to produce new products quickly					
In our firms, there is the technology to respond quickly to changes in demanded					
In our firm have the technology to produce a variety of products quickly					
Our setup time is very short					
Our products rapidly go through market introduction, growth, maturity, and decline					
We change internal processes and products quickly					
In our firm, product life cycles are getting Shorter					
In our industry, product life cycles are very short					
Our customers are involved in the product design					
Our supplier are involved in process changes					

Our firm has reliable supplier in terms of quality					
Our suppliers are reliable in terms of delivery time					
We use special tools to shorten setup time					
We have capabilities of changeover to a different product quickly					
Our firm is in partnerships with suppliers and distribution of final products					
During new product development, we involve our supplier					
Our employees quickly develop new manufacturing strategies					

Section four: Lean

This section addresses the level of lean of the firm operations. Using the scale provided indicate the extent to which you agree with the following statements with regard to your firm. 1= strongly disagree and 5 = strongly agree

lean manufacturing items	**Strongly disagree 1**	**Disagree 2**	**Moderate 3**	**Agree 4**	**Strongly agree 5**
Our firm does not make more product than what is immediately required					
Our plant is fully utilized					
We delay in production due to unprocessed work in progress					
Our firm keeps only essential items in the manufacturing floor					
Our manufacturing area is kept clean and maintained using preventative measures to keep it clean					
Our employees are provided with hazard warnings and safe work instructions					
Our production routines and schedules are properly maintained					

We have no reworks in manufacturing process					
Our firm can identify causes of quality problems					
We conduct process capability studies and trainings to avoid defects					
Our employees understand their influence on the organization overall efficiency					
Our production targets and goal are always revised					
Our employees are regularly trained to reduce waste					
In our firm feedback on work done is provided to avoid delays					
Our firm always collects and analyses production data					
Our employees are involved in problem solving					
Our firm has quality improvement plans					
Our firm we prioritize improvement programs					

Section five: leagile

This section addresses the integrated use of lean and agility manufacturing practices among the manufacturing firms. Using the scale provided indicate the extent to which you agree with the following statements with regard to your firm. 1= strongly disagree and 5 = strongly agree

Leagile manufacturing indicators	**Strongly disagree 1**	**Disagree 2**	**Moderate 3**	**Agree 4**	**Strongly agree 5**
Our products and inventory are always at the right place at the right time					
Our organization has two autonomous divisions: one that produces product and the other buys from the production to sell to customers					
Our company has system that allows smooth flow of materials					
We produce products after receiving orders					

Production is delayed until the orders have been received					
In our firm, there no excessive inventory movements					
In our company, product differentiation is driven by end users					

Section six (a): Plant performance

This section addresses the level of plant performance of manufacturing firms. Using the scale provided (i.e 1= strongly disagree and 5 = strongly agree) indicate the extent to which you agree with the following statements with regard to your firm.

Indicators of performance		**Strongly disagree 1**	**Disagree 2**	**Moderate 3**	**Agree 4**	**Strongly agree 5**
Profitability						
	The profits of our company have been growing for the last four years					
	Our company always transfers part of the net profit for re-investment					
	Our company usually meets her revenue targets					
	Profitability is a result optimal utilization of equipment					
Return on investment	Our return on investment has improved for the last four years					
	investment depends on annual profits made					
	Our return on investment depends on the costs of production					
Cost of	The assets of our					

conversion	company are optimally utilized Waste always affect our return on investment Our firm finds costly to introduce new product line Costs of holding inventory have reduced Costs of staff training programs have reduced					
Growth in market share	The market share of our company has grown due to differentiated products					
	Our customer request for new product designs					
	We have made more sales in a newly designed product					
Manufacturing lead time	Our company has short cycle time					
	Orders are fulfilled in the shortest time possible					

Section seven: Other strategies pertinent to plant performance in manufacturing

This section addresses other manufacturing strategies that have an impact on efficiency of manufacturing firms

Strategies	**Strongly disagree 1**	**Disagree 2**	**Moderate 3**	**Agree 4**	**Strongly agree 5**
Our firm created multiple processing stations to improve					

performance					
Large scale production has expanded our market share in our firm					
Our firm create a variety products to increases profitability					
Our work teams take significant actions without supervisors					
Our supervisors are supportive of the decisions made by our work teams					
Integration of processing units has improved plant performance					
We have written rules and procedures to improve performance					
Our firm has created a number of designs to improve performance					
Our tasks are done through cross-functional teams to have better performance					
Our most important tasks are carried out by cross-functional teams					
Conducive communication channels have improved performance					

Appendix x: WORK PLAN AND TIME FRAME

This research survey will be conducted according to the work schedule below

Activity	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	April 2017	May 2017	June 2017
Fine tuning the questionnaire and proposal								
Pilot study								
Consulting the supervisors for guidance								
Testing questionnaire items for validity								
Consulting the supervisor and making corrections								
Delivering and sending questionnaire for Large scale survey								
Sending the 1st reminders to respondents								
Sending the 2nd reminder								
Receipt of questionnaire								
Editing and summarizing the data collected								
Summarizing and analysis of data collected								
Consultation with the supervisor								
Preparation of final report								

❖ [i]**Sort** refers to the practice of going through all the materials and items in the manufacturing floor and keeping only essential items. Everything else is either stored off-site or discarded. The goal is to eliminate nonessential items from the workplace to avoid confusion and wastage. It is therefore important to dispose of, recycle or donate those items that have been in the manufacturing area for a specific period of time.

❖ **The Shine step** includes three primary activities which include getting the manufacturing area clean, maintaining its appearance, and using preventative measures to keep it clean. Each team member should be equipped with adequate cleaning materials for cleaning equipment, tools, work surfaces, desks, storage areas, floors, lighting, and anything else that affects overall cleanliness. Equipment that is kept clean performs more efficiently, has less unscheduled downtime, and reduces costs to the company (Duc & Andrew, 2012).

❖ **In "set in order"** the work area is analyzed for additional improvement opportunities and look for ways to reduce sources of waste and error as well as to make the manufacturing area more visually instructive. The manufacturing team puts special emphasis on the following:

✓ Organize and label facilities and equipment and ensure operator tools and material inputs are near the point of use.

✓ Alerting people to potentially hazardous situations and controlling actions to prevent an unsafe condition and providing hazard warnings and safe work instructions at the point of need[i].

✓ Focus on employee's ability to execute job responsibilities within a given workplace[i].

✓ Focus is on graphical or physical representation of quality standards[i].

- ✓ Clearly identify production demands and materials movements[i].

❖ **Standardize** phase helps in identifying ways to establish the improved workplace practices as a standard. The goal of this phase is legitimize best practices among manufacturing team[i]. Team leaders and supervisors need to commit to the initiative in order to provide guidance, as well as to provide general support to the manufacturing team.

❖ **Sustain step** maintains the momentum generated during the initial event. A management audit should be put into practice to ensure that employees understand that maintaining the level of workplace organization is a top priority. Management audits should focus on ensuring that the routines and schedules are properly maintained. The audit also provides an excellent review programs for continuous improvements.

COMMENTS FROM REVIEWERS	
Comments from REVIEWER A	
At this stage, what is important is the table of contents, abbreviations and acronyms. All are provided. However, the title of the study needs some clarification. It seems too broad to manage.	The scope was re-addressed and adjusted focusing at Uganda for empirical study
Introduction The introduction is too verbose and lacks clear direction. Probably it lacks the format of the institution. The candidate needs to be guided on how to generate an intelligible background that flows logically into the problem statement.	The introduction has been refurnished in line with the UTAMU guidelines to logically flow into the problem statement
Problem statement The problem statement reads like literature review. He needs to clearly articulate the problem so the reader can know what is going to be investigated. In its state, it is literature-like rumbling without clear direction.	The statement of the problem has been refined to articulate the prevailing state of the phenomenon in the Uganda context
Purpose of the study This section needs clarity as well. In its current state, one might thing of a second section of literature. Let the candidate keep it brief and concise	The purpose of the study has been fine-tuned for clarity
Objectives The objectives are fairly formulated but the scope is not known. They are too generic. The introduction for the objectives should be minimized to make it easy to understand. Otherwise some fair effort	The scope of the study is now reflected in the objectives
Research questions Fairly developed but the introduction part should be minimized.	The research questions are discretely stated
Research hypotheses This section is mixed up with a lot of literature. Secondly, because of the mixed, literature, the candidate was not able to generate logical hypotheses.	Literature among the hypotheses has been removed

Literature review I must say, you need to subject this literature to some plagiarism test. I find lots of inconsistencies and statements that do not flow to support the current study. The candidate seems to be telling other people's stories instead of his. Even the figures in the text are too many without being linked to the current study. He should be guided.	Figures in the text have been pushed to the appendices and consistence of the ideas has been taken care of.
Methodology The candidate made some fair effort in this section as well as providing some justification.	
References A number of cited materials are not referenced. This should be addressed	All cited works have been referenced

COMMENTS FROM REVIEWER B

Preliminary issues The preliminary issues are clear and in line with generic structural standards of any given proposal.	
Introduction i. The introductory chapter needs to be reorganized. There is a lot of uncertainty on what the candidate intends to research on. There are some repetitions of information here and there, and moreover the candidate does not clearly guide the reader. The story line needs to be coherently presented. Some sections give an impression of cut and paste (these sections have been pointed out in the proposal). ii. The background to the study section should present the rationale by providing evidence and conditions of the existing situation to make the reader feel the urgency of the problem and the need to study it in order to solve it or contribute to its solution. The background must demonstrate mastery of the subject to be investigated. Indeed, the section must demonstrate that you area ware of the historical evolution and theoretical developments of the study area. It must be consistently and carefully written.	The storyline has been presented in the introduction to clearly bring out the issue under the study and how it will be addressed The historical perspectives and existing situation have been reflected in the introduction Contradicting conceptual and theoretical propositions have been considered in formulating the problem The rational for the study has been provided in this section

Problem statement i. The problem statement being the heart of this research should indicate the urgency why the candidate should conduct the study. The advised to consider the four generic qualities of the research problem that need to be emphasised namely: researchable, theoretically or practically significant (should contribute to the improvement of knowledge), clear and ethical. Therefore, this statement should clearly define the variable(s) and show the relationships / issue(s) that will be investigated. ii. Reference in this case should be made to the problem that has been detected and needs either a theoretical and practical solution, or both.	The research problem is now addressing the theoretical and empirical contradictions concerning the phenomenon
Purpose of the study The purpose of the study is not clear. The candidate should note that the purpose of the study spells out how the postulated relationships will be investigated and what the researcher hopes to achieve by carrying out the proposed study. More, importantly the above is derived from a clearly incised problem statement. **Objectives** i. The objectives of the study are not clear since the problems statement need to be adjusted .Note that the specific objectives arise directly from the general objective of the study. The specific objectives/objectives area break down of the general objective or purpose of the study, respectively. Each relationship between variables to be investigated should be spelt out in a specific objective. The objectives must be aligned to the conceptual frame work and the variables of the study.	The purpose of the study now clearly spells out the relationship between the study variables The objectives have been aligned to the variables under investigation
Research questions There search questions will only be meaningful when objectives are clearly set.	Done
Research Hypotheses The hypothetical issues will only be meaningful when research questions and objectives are clear	Done

Literature review i. The literature need to be rearranged. The candidate's voice need to be felt. And at PhD level rigorous analysis is expected, not the cut and paste as evidenced in some sections. Note that literature review is an account of what has been published on a topic by accredited scholars and researchers. It presents a survey and discussion of the literature in a given area of study. It is a concise overview of what has been studied, argued and established about a topic, and it is usually organized either chronologically or thematically. In writing the literature review, you are expected to convey to the readers what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are. ii. The candidate is also expected to demonstrate skills in two areas namely (1) information seeking: the ability to scan the literature efficiently, using manual or computerized methods, to identify a set of useful articles and books and (2) critical appraisal: the ability to apply principles of analyses and value judgement to identify unbiased and valid studies on a problem under investigation, and be able to detect and present the research gaps in a scholarly way. It's from such backdrop that the presented literature review should: 1. be organized around objectives, themes or concepts related to this study. 2. synthesize results into a summary of what is and is not known. 3. identify areas of controversy and gaps in the literature. 4. formulate questions that need further research.	The literature has been re-arranged to have clear arguments about the issue under investigation The literature has been organized in majorly three sections: theoretical review, conceptual review and the existing empirical evidences
Methodology The chapter needs to be improved especially; sampling data collection and instruments and analysis techniques. It's also important to illustrate how the data collections methods are going to be employed and the nature of the respondents; and the reasons of choosing those particular respondents.	The major reason for choosing the respondent lies in the ability to understand the manufacturing concepts
References The candidate has an excellent reference list. Easy to track, though not sure about the recommended referencing style by UTAMU	

Other comments Overall, the proposal is fair but the candidate should note thefollowing: i. Each chapter should have an introduction and conclusion, so that the conclusion informs there are what has been done and also provide an entry point for the ensuing discussion ii. The proposal still has number has numerous grammatical errors, typos and language rules. The candidate is advised to thoroughly revise the proposal to eliminate the above Am optimistic that the conceptual confusion can and the scope and can be corrected with guidance from supervisors	Every chapter has the introduction and the conclusion Grammatical errors have been rectified
COMMENTS FROM REVIEWER C	
Preliminary issues Are well presented, coherent and appropriate. **b) Introduction** Well developed and able to guide the study	
c) Problem statement i. Fairly good ii. However, should give a reader more light on the situation of the efficiency in the manufacturing firms in Uganda and related assumptions so far why the situation occurs to be what it is. iii. What is on record in as far as approaches of time- based manufacturing in most of the industries?	The dependent variable has been adjusted to plant performance and reflective indicators thereof spelt in the study
c) Purpose of the study Is well presented. **d) Objectives** i. Objective 1 seems like the purpose of the study ii. This suggests that the focus should be on objective 2 & 3. Indeed your theoretical framework suggest so	Objectives have been changed and they are in line with the theoretical framework
e) Research questions Should be aligned to objective 2 & 3	Done

f) Research hypotheses If well aligned to the objectives 2 & 3, they should be able to respond to the study purpose.	Generally objectives have been changed thematically in three-folds
g) Literature review Good but also show how the indicated theories fit in the conceptual and literature reviewed. They seem to be a bit disjointed. This should emerge in the argumentation.	The theories brought on board, now reflect how the study variables in the conceptual framework interract
h) Methodology i. Review the sampling section to precisely indicate the samples to be selected amongst the target study population ii. Sampling techniques also need to be more refined	The sample will be selected from Kampala region as the largest manufacturing hub The sampling techniques have been fine-tunned
i) References The references seem to cite the first name which is contrary to the ideal referencing/citation.	References have been changed using APA and last name is utilized in this case
j) Instruments The research objectives and questions do not suggest a quantitative study. Therefore the questionnaire of a likert scale may not be appropriate for the study **k) Other comments**	The objectives have been changed to reflect the quantitative nature of research
There is a need to review objective 1 and to distinguish it from the study purpose Consider review of the Instruments suggested.	All objectives are distinguished based on the study variables
l) Overall recommendation The proposal be accepted with MINOR corrections	
COMMENTS FROM PANELISTS	

i. Scope too narrow. Title to be reformulated. ii. Reformulate the topic and ensure that everything will flow. iii. Scope?? Kampala. iv. Fairly well developed but could be improved with more reading on the subject area. v. Title: Time based manufacturing practices and efficiency of manufacturing firms. vi. Theory of capability Vs theory of constraints. vii. The concept being used in this proposal is not clear. viii. The author needs to do more readings on the efficiency theory. ix. Why moving to theory of constraint, theory of dynamic compatibility and convergence theory and leaving out efficiency theory? x. The topic should be adjusted and fit a PhD study.	1. The topic has been expounded. The refined topic is: Time based manufacturing practices and production efficiency of manufacturing firms in developing countries: empirical evidence from Uganda 2. The scope of Kampala has been extended to Uganda as a representation of developing countries 3. The modern economic theory that highlight efficiency from the producers' perspective has been utilized
b) Introduction i. Lacks clarity ii. Fairly clear but could be refined based on the wide literature in this field. iii. Fairly presented but needs to be expounded upon.	The introduction has been revised to systematically show the logic flow of the idea about the topic and the state of this phenomenon in uganda
) Problem statement i. Literally like review ii. What problem do you want to address? iii. Social/practical. Knowledge. iv. Efficiency theory. The Efficiency of manufacturing firms. v. Refine your problem statement to make it more clear. vi. What knowledge gap are you filling? vii. Not clear; should be improved upon. There is no problem statement it is only literature review.	Problem statement has been revised The issue under this study concerns a question of why are time based manufacturing practices not conventionally recognized as antecedents to production efficiency by developing countries despite having eminence among firms in developed countries?
d) Purpose of the study i. Refine. ii. Not adequately presented.	The purpose has been refined
Objectives i. Refine. Only two objectives are not enough for management study. There is need for at least 6 questions	The objectives has been increased to three

Research questions i. Refine. ii. Should be expounded upon in line with the objectives of the study.	Reviewed in line with the objectives
) Literature review i. Be critical. ii. Read more on efficiency of firms. iii. May adopt efficiency theory. iv. Should further be reviewed.	Theories relating agility lean and leagility have been brought on board to lay the foundation of the study
) Methodology i. Okay. ii. Why use 2 questionnaires. iii. Review. iv. Sampling- Random Collection of data- in Phases v. instruments-2 questionnaires-self-administered- research administered. vi. Why- which people/respondents. vii. Read on efficiency theory viii. Simplify language for readers in the field. ix. This is not clear. First need to adjust the topic as well as objectives of the study and instruments.	The study will be carried out using one questionnaire though administered differently The major respondents will be senior officers who have knowledge about the practices of manufacturing
References i. Okay. ii. Fairly presented. ***k) Instruments*** i. Refine. ii. Why use two questionnaires ***l) Other comments*** i. Refine. ii. Use a simplified language for readers. iii. Could seek and obtain more guidance from economics professionals to improve your work.	One questionnaire will be used though addressed to different classes of people The language used has been revised to contain the understanding of every reader
Overall recommendation i. Could reformulate the topic. ii. Why use hypothetical study	Hypothetical study is used because the relationship between the variables has been studied in developing countries none-the-less researches addressing the issue in developing countries context is scanty