ST. MARY'S UNIVERSITY

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BUSINESS ADMINISTRATION

FACTORS AFFECTING OPERATIONAL PRODUCTIVITY OF PESTICIDES MANUFACTURING INDUSTRY IN ETHIOPIA: THE CASE OF ADAMITULU PESTICIDES FACTORY

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BY: SEIFEDIN BEREDIN

SGS/0520/2007A

ADVISOR: MARU SHETE

(PhD, ASSOCIATE PROFESSOR)

JULY, 2021

ADDIS ABABA

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APPROVED BY BOARD OF EXAMINERS

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Dean of School Business	**Signature**
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Advisor	**Signature**
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External Examiner	**Signature**
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Internal Examiner	**Signature**

DEDICATION

I dedicate this thesis as an excellent achievement of my educational life to all members of my family, especially to my mother Shitaye Mohammed and my father Beredin Mohammed who devoted their life to grow up me and my beloved wife Semira Kemal who is always supporting me. I will forever remain indebted to you all.

DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of **Maru Shete (PhD and Assoc. Prof).** All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part on in full to any other higher learning institutions for the purposes of earning any degree.

Seifedin Beredin ________________________________

Name Signature

St. Mary's University

Addis Ababa

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate Studies for in Partial Fulfillment of the Requirements for the Award of Degree in Masters of business administration with my approval as a university advisor.

MARU SHETE (PhD and Associate Professor) _______ ________

Name of Advisor Signature

St. Mary's University, Addis Ababa

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List of Abbreviations and Acronyms used

APF	Adamitulu Pesticides Factory
ANOVA	Analysis of Variance
CSA	Central Statistics Agency
EPA	Environmental protection Authority
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
GDP	Gross Domestic Products
IT	Information Technology
KMO	Kaiser Maier Olkin
MOFED	Ministry of Finance and Economic Development
MOA	Ministry of Agriculture.
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary List Square
SNS	Social Networking Sites
SPSS	Statistical Packages for Social Science
WHO	World health organization

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ABSTRACT

This study aimed at investigating factors affecting operational productivity of Adamitulu Pesticides Factory (APF). In this study, the data was collected from 115 samples of employees of APF through structured questionnaire using Stratified random sampling techniques through simple random sampling procedure with lottery method. Descriptive analysis, factor analysis and multiple regression was employed to examine factors affecting operational productivity such as quality, management, technology, human resource, capital and ergonomics\safety. The result showed that quality, technology, human resource issues and management related issues had a significant and positive effect on operational productivity. However, capital and ergonomics/safety had a small to very small effect on operational productivity and were not significantly affect the operational productivity. The study suggested that the management at Adamitulu Pesticides Factory and stakeholders need to improve productivity by addressing quality, management, technology and human resource related challenges.

Keywords: operational productivity, factor analysis, Adamitulu Pesticide Factory, linear regression model.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Ethiopia is among the rapidly growing economy in Sub-Saharan Africa with an average growth rate of 10.5% for the past successive years (MoFED 2014/15). Agriculture is the second most dominant sector next to service sector of the economy. Agricultural production accounts for 42% of Gross domestic production (GDP), employs 84% of the population (MOA, 2013). Since the 2000s, Ethiopia has emerged as one of the fastest-growing economies in Africa. Nevertheless, the manufacturing sector is still far from being an engine of growth and structural change. The manufacturing sector plays a marginal role in employment generation, exports, output, and inter-sectorial linkages. In some ways, the structure and performance of the Ethiopian manufacturing sector mirrors the wider sub-Saharan African experience (Lawrence, 2005).

Following the implementation of the National Industrial Policy in 2002, the industrial sector in general and the manufacturing sector in particular were given due national attention. This policy was designed within the framework of free-market economy underlying global economic policy. The same policy has identified priority sectors and developed a platform to ensure that the industry sector play a key role in the economy. The identified priority sectors included textile and garment, leather and leather products, chemical, metal, agro-processing and construction industries (MoFED 2014/15).

Despite Ethiopia's resource endowment to produce sufficient food for domestic consumption and export, it remains a net importer of basic food items. Smallholder farming with low productivity dominates Ethiopia's agricultural sector and high dependency on rain fed agricultural systems. An important component of the causes of low agricultural productivity in Ethiopia is the low use and adoption of productivity enhancing technologies such as improved seed varieties, pesticides and fertilizers (TAK-IRDI, 2016**).**

The use of agro-chemicals (fertilizer, insecticide, herbicide and fungicide) is growing rapidly. However, the coverage and application rate is very low among smallholder farmers while the annual nutrient depletion rate is very high. This indicates that consumption of agro-chemicals in the country is expected to grow even further (TAK-IRDI, 2016**)**.

Given a large recent interest in the use of pesticide products particularly in the agricultural sector, encouraging local pesticides formulators and local production contribute to the national economy in different ways including employment generation, foreign export earnings through export of pesticides products, and spill-over effects in other sectors of the economy. Furthermore, the country can avoid excess inventory resulted from importing a large amount of pesticides from abroad in the expectations of the occurrence of pests in the country. However, the local formulators in the country can provide fresh products to the market based on the prevalence of the pest in the country. Consequently pesticides are less likely to be obsolete as a result of not being used in the farm (TAK-IRDI, 2016**)**.

Productivity is a collective measure of how well a country, industry, or business unit is using its resources (factors of production). Since operations management focuses on making the best use of the resources available to a firm, productivity measurement is crucial to understanding operation–related performance. In its broadest sense, productivity is defined as outputs divided by inputs (Chase et al. 2007).

To increase productivity there is a need to make ratio of outputs to inputs as large as possible. For the survival of any organization, this ratio must be at least 1. If it is more than 1 the organization is in a comfortable position. Thus, the objective of the organization should be to find ways and means to improve productivity to the highest possible level. Several strategies for improving productivity include increased output for the same input, decreased input for the same output, proportionate increase in the output is more than the proportionate increase in the input, proportionate decrease in the input is more than the proportionate decrease in the output and simultaneous increase in the output with decrease in the input (Paneerselvam, 2006).

Firm productivity is an essential indicator of the strength of firms to stay in operation, expand, and compete in local and international markets and thereby contribute to employment, income, and generating essential foreign currency (Tsegay et al., 2018). Thus, increasing the productivity of the local formulator has important implications for policies related to agricultural sector, improving the challenges, and optimal benefits from the sector.

1.2. Statement of the problem

Agriculture contributes a large share of Gross Domestic Production (GDP) in the Ethiopian economy and the agricultural sector depends on chemical pesticides. The sector receives the pesticides from both domestic and foreign market. Adamitulu pesticide Factory (APF) has been the government owned company which manufactures and sell pesticides for local consumption. Furthermore, there are many other private companies that import pesticides for domestic market (TAK-IRDI, 2016).

Pesticides market in Ethiopia has been increasing in the last two decades because of the introduction of free market economy in the country and the intensification of agricultural production. Hence, in addition to APF a number of private companies enter into the market gradually with the same direction of the demand trend (MOA, 2010-2015). It is pertinent to note that as the world is increasingly becoming a global village, there is a lot of competition from industrialized countries to use developing countries like Ethiopia as a dumping ground for obsolete products (Belay, 2016). Similar to other imported products one can expect that the domestic pesticide market has been flooded with cheap imports and this adversely affects the products of the APF and threatened its competitiveness in the domestic market. As the data shows that the amount of the pesticides to the Ethiopian market increase time with time but still the share of APF decreased and unable to provide for the market as per the sector demanded (MOA, 2010-2015).

The Ethiopian manufacturing sector still face several constraints that needs to be addressed. Some of these constraints include lack of improvement in the management of firms, selection of inputs, timely maintenance provision, efficiency in the supply and stock holding of raw materials, and supply of utilities as the reasons (FAOSTAT, 2014).

The performance of manufacturing sub sectors has been registering less productivity against higher expected potentials. For example, a report from Ethiopian Central Statistical Agency (CSA) showed that almost 50% companies engaged in manufacturing sector in Ethiopia suffer from low productivity as low as 34% of their potential on average and also the productivity of the priority areas of the manufacturing sector in the country like garment and leather are far below their potentials (Addis Standard, 2013).

Determinants of productivity has been studied, labor productivity, total factor productivity, and technical efficiency of the Ethiopian manufacturing sector in a way to analyze the effect of trade liberalization. Unless these problems are properly recognized and addressed, it is difficult to maximize the benefit of this sector to the country's economy (Kuma, 2002)

In general, productivity is the ratio between the outputs to inputs used in production. By definition, productivity performance reflects the relative growth of factor inputs and outputs in a certain period. In his study, Fuglie (2004) states that an increase in factor productivity is equivalent to an outward shift in a production function, which is caused by an increase in the amount of output per unit of input (DawaAji, 2012).

A strategic report of APF (2010-2018) documented that, due to the factories poor resource utilization in the production process it was unable to deliver products which are required by the market. For instance, according to the APF report, the company got lost sales of the following products, Ethiolathion 5% Dust, Ethiopoxur 8% WP, Ethiothoate 4% EC and Ethiozinon 60% EC. The company was unable to meet the customers demand due to bottleneck problems in the production competence. The company have faced similar problem from 2015-2018. Since most of the pesticides are seasonal, are not to be marketed year to year and also the limited shelf life pesticides (FAO, 2003). Thus, being productive in the production of products is a key for success. Accordingly, as the productivity of APF increase, there is a possibility of increasing delivering pesticides market in quality and as well with reasonable price.

The demands for the pesticides are expected to grow exponentially. Under a very conservative estimate where the current usage and application rate is assumed to hold pesticide demand is expected to be more than triple by the end of 2020 (TSMAG, 2011). However, in the face of the current growth pattern and government commitment for adequate food supply for all through increasing agricultural productivity, the actual demand is expected to be much more than these estimates. In other words, the need of improving the efficiency through the usage of agrochemicals is drives the market demand (TAK-IRDI, 2016).

The sector deserves due attention in terms of devising alternative strategies that can ensure increased operational productivity, improved efficiency and competitiveness in the pesticides market. In this regard, examining factors influencing operational productivity of APF can provide important information for company policy makers. Such information can be used to design targeted intervention aimed at increasing the operational productivity of the sector and maintaining its sustainable growth.

Some attempts have been made by several researchers to study the determinants of productivity in the manufacturing sector in Ethiopia (e.g., Bigsten & Gebreeyesus, 2007; Gebreeyesus; 2008; Rijkers, S’oderbom and Loening, 2010). However, a careful scrutiny of the pesticides industries is warranted to addresses specificities of the industries that one cannot learn from general studies of the manufacturing sector.

Looking at the above information, it emerges that factors affecting operational productivity of manufacturing sector in Ethiopia have not been adequately addressed although many industries are experiencing low operational productivity. In addition, to the best of the researcher knowledge and based on the available literature so far, sufficient study was not undertaken on the operational productivity of the pesticide industry in Ethiopia. In this regard, this research is proposed to investigate factors affecting operational productivity of the pesticide manufacturing sector by taking APF as a case in Ethiopia. This study was aimed to address gaps mentioned above by examining specific factors that can influence the operational productivity in the context of the Ethiopian pesticides industry.

1.3. Objectives of the study

1.3.1 General objective

The overall objective of the study is to identify factors that affect operational productivity of Adamitulu Pesticides factory.

1.3.2 Specific objectives

a. To investigate the quality effects on operational productivity of APF.

b. To examine the effect of management on operational productivity of APF.

c. To look in to the effect of technology on operational productivity of APF.

d. To study the effect of human resource on operational productivity of APF.

e. To explain the association between capital and operational productivity of APF.

f. To determine the effect of ergonomics/safety on operational productivity of APF.

g. To prioritize the factors according to the degree of their effect on operational productivity of APF.

1.4. Research Hypothesis

Most of empirical findings indicate that factors like management, technology, human resource, capital, quality and ergonomics/safety issues have influence on operational productivity. Therefore this study explores the effect of these factors on operational productivity of APF. Based on that, the following hypotheses are developed.

H1: There is a positive and significant effect of quality on operational productivity.

H2: It is expected that there will be a positive and significant effect of management on operational productivity.

H3: It is expected that there is a positive and significant effect of technology on operational productivity.

H4: It is expected that there is a positive and significant effect of human resource on operational productivity.

H5: It is expected that there is positive and significant effect of capital on operational productivity.

H6: It is expected that there is a positive and significant effect of ergonomics/safety and operational productivity.

1.5. Definition of terms

Quality: quality can be defined as meeting the requirements of the customer, conformance to specification and supply of products which do not come back to the firm. There is a clear relationship between quality and productivity, when quality of product increases productivity also increases because waste is eliminated during production process.

Management: defined as a process in which a group of people direct actions towards a common goal. It also includes activities of setting the strategy of a company and controlling the efforts of its employees to accomplish its objectives through the utilization of available resources. Management is responsible for ensuring that labour and capital is effectively used to improve productivity.

Technology: is a knowledge, process, system and product used in the production of goods and services and also it is a practical implementation of learning and knowledge by organization to aid human endeavor. Technology has played a dominant role in the productivity growth and has provided a competitive advantage to firms that have adopted it early and implemented it successfully.

Capital: is a resource measured in terms of money used by firms to make products or to provide their service to the sector of the economy upon which their operation is based. Investing capital on acquisition of production equipment or upgrading of the existing is essential for improvement of productivity.

Human resource: describe both the people who work for the organization and the department responsible for managing resources related to employees. Labour Skill, knowledge and incentive mechanisms are critical for enhancing productivity at firm level.

Ergonomics/Safety: ergonomics deals about interactions between people and their physical and organizational environments. When people's workplace conditions and job demands match their capabilities, safety and productivity improve. The conceptual framework which guides the study is as presented below.

1.6. Significance of the Study

The study contributes to the literature in the field. Specifically, the findings of the study will be used by the APF; the study will provide information on the general factors affecting the operational productivity of APF, which the company can use to enhance its productivity and competitiveness in order to facilitate informed decision-making at all levels of the organization. This will provide a basis for analysis of future program investments. Further, the findings in this study will enable the APF to develop winning strategies in the turbulent environment by developing competence and capabilities derived from the suggested responses from the study.

Finally, the study serves as a reference for further study on area of operational productivity of Ethiopian agrochemical industries specifically and for manufacturing industry in general.

1.7. Scope and Limitation of the Study

The study was conducted in Ethiopia and covers only one local pesticide company named, APF. The scope of the study investigated the major factors that determine productivity of APF. In addition, the research only focused on the six factors (management, technology, human resource, capital, quality and ergonomics/safety issues) affecting operational productivity. The six factors are considered as independent variables and operational productivity as a dependent variable. However, the study has some limitations, which include response bias as the respondent may be reluctant to share genuine information, fearing that the information they provided with the researcher could potentially be used by other pesticides company.

1.8. Organization of the paper

The remaining chapters of the paper are organized as follows. Chapter two dedicated to the review of related literature. Chapter three presents the methodology part, which includes research design, data source and types, target population, sampling and sampling techniques, data analysis Procedures, model specification, and variable description and measurement. The fourth chapter is committed to demonstrate data presentation, analysis and findings, while the fifth chapter contains summary of findings, conclusion and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This section of the study provides theoretical and empirical literature, as well as conceptual framework from global and Ethiopian perspectives. Furthermore, the chapter presents the research gap on factors of competitiveness of Pesticides industry.

2.1. Theoretical Literature Review

2.1.1. The Concepts of Productivity

Productivity is generally defined as the relation of output (produced goods) to input (consumed resources) in the manufacturing transformation process (Sumanth, 1994). Productivity as related to manufacturing means how much and how well a company produce from the resources it used. Productivity can be increased by producing more or better goods from the same resources. Put differently productivity can also be increased by producing the same goods from lesser resources (Bernolak, 1997).

The definition of productivity captures two important characteristics. First, productivity is closely related to the use and availability of resources. This means that a company's productivity is reduced if its resources are not properly used or if there is a lack of them. Second, productivity is also strongly connected to the addition of value. Thus, high productivity is achieved when activities and resources in the manufacturing transformation process add value to the produced goods (Singh, et al 2000).

The term resources in production activities refer to all human and physical entities necessary for the production of goods or delivery of services. In other words, these are factors of production. The resources that people use include land and buildings, fixed and moving machines and equipment, tools, raw materials, inventories and other current assets (Chase, et al. 2007).

For the survival of any organization, the ratio of outputs to inputs must be at least 1. If it is more than 1 the organization is in a comfortable position. To improve productivity it needs to make the ratio of outputs to inputs as large as possible. Thus, the objective of an organization should be searching for ways and means to improve productivity to the highest possible level. Several strategies for enhancing productivity include increased output for the same input, decreased input for the same output, proportionate increase in the output is more than the equivalent increase in the input, proportionate decrease in the input is more than the proportionate decrease in the output and simultaneous increase in the output with decrease in the input (Paneerselvam, 2006).

Productivity assessments can be made in two ways. First, industry can compare its operations with similar operations within its industry, or it can use industry data where such data's are available. Another method is to measure productivity over time within the same operation (Chase, et al., 2007).

Productivity is the most widely used measure of operations. It shows the amount produced for each unit of the resources used. There are several kinds of productivity. The broadest picture of operations comes from total productivity (the ratio of total output to total input) which relates production to all the resource (inputs) used (Walters, 2002).

By inputs is meant all the resources including employees, raw materials, energy, building, equipment and so on that are required or used to manufacture a product or deliver a service (Williams, 2002). Reducing inputs - essentially, cutting costs for the same (or greater) levels of outputs, which is commonly adopted as means of increasing productivity (William, 2002). Output is typically taken to mean what an industry or a firm produces or the service it delivers (Williams., 2002).

However, there are practical difficulties in defining "total" output and/ or "total" input. Because of these practical difficulties, most organizations use partial productivity, which relates the output to a single type of input. If a process uses 25 hours of machine time to make 50 units, then the productivity is two units per machine-hour. Partial productivity is thus defined as the ratio of total output to units of a single resource used and it includes: equipment productivity, labor productivity, capital productivity, energy productivity (Walters, 2002).

2.1.2. Measurements of Productivity

Productivity changes can either be caused by arrangements in the "best practice" technology or changes in the level of efficiency. Some of the basic measures of productivity are output, labour and capital. Output can be defined as the real output produced in a given period of time limit. The sales or revenue figure normally reported in accounts can be used as a measure in comparison with previous years or other firms in the industry (Mark, 1998). Labour quantity is normally measured in terms of the number of employees. In theory, labour could be split into various separate inputs depending on skill, education, or other classifications (Bii, 2008). The measurement of capital is perhaps the most problematic of inputs to measure (Morrison, 1998).

According to Rai (publication year here), there are a number of ways to measure productivity. Following are some of the measures in common use:

Labour productivity: defined as a real economic output per labour hour.

$$\text{Labour productivity} = \frac{\text{Amount out put}}{\text{Amoun t of labour}}$$

Capital productivity: shows how efficiently capital is used to generate output.

$$\text{Capital productivity} = \frac{\text{Turn}}{\text{Capital Employed}}$$

Profit productivity: is determined by how much money is left over after a product is produced and all expenses are paid.

$$\text{Profit productivity} = \frac{\text{Profit}}{\text{Investment}}$$

Energy productivity: it is an indicator of economic of output that is derived from each unit of energy consumed.

$$\text{Energy productivity} = \frac{\text{Out put}}{\text{Quantity of energy used}}$$

A general measure of productivity can be defined as:

$$\text{Productivity:} \quad \frac{\text{Out put}}{\text{Labor + Capital + other input}}$$

Each kind of measure needs some specific kind of information. The appropriate measure can be selected on the basis of information available and the objective of investigation. In fact the measure of productivity indicates the performance of inputs namely labor and capital in an enterprise. Increase in output is not an indication of increase in productivity. Production is an absolute measure and productivity is a relative measure.

According to the OECD (2001), the objectives of productivity measurement can be summarizes as follows:

Technology: objectives of measuring productivity growth are to trace technical change.

Efficiency gains: a firm's internal efficiency is an important factor for its economic viability-efficiency both in terms of the use of inputs, given technology (technical efficiency) and in combining its inputs, given technology and market prices (allocate or price efficiency).

Benchmarking production processes: productivity measure can be used to compare a given production process across firms in the same industry.

Living standards: productivity matters because it is the main determinant of national living standards.

Productivity measurement may be made at various levels and productivities are to be measured for the uses of different purposes in international, national and industrial level. For example, productivity measurement at the industrial level can be of use as economic indicators. This may also be used to analyze the manpower utilization or industry performance. On the other hand, productivity measurement at industry level will support to study the productivity of resources used. Higher industry productivity will guarantee higher real wages. Public will realize greater social benefits. Consumer will pay lesser price from increased use value through increased productivity (Rama Murthy, 2005).

Operational productivity variables include flexibility which leads to frequent new products and services, or a wide product and service range; reduced/short delivery time which leads to faster operations; improved quality of products and services resulting in no errors in processes and thus no wastage of time or effort in having to re-do things; dependable delivery; reduced cost of operations and so increased profitability; increased efficiency leading to a reduction in operational costs; and increased employees productivity so that employees are able to do more within a shorter period of time(Grossman,1993).

2.1.3. Overview of Global and Ethiopian pesticides Industry

2.1.3.1. Global pesticides Industry and Production

Pesticide sales increased by 289% between 2000 and 2010. However, the growth in 2009-2010 tapered off at 1.1% and the market grew to $44.2 billion due to major adverse weather phenomenon globally, including flooding in Canada and Central Europe, record drought in Vietnam and heat waves in Russia. The medium-term demand outlook remains upbeat, with an expected growth of 4% annually till 2015 (TSMAG, 2011), Globally, the manufacturing and consumption of pesticides have been increasing rapidly. Use of pesticides increased greatly during the Green Revolution in the 1960s and beyond. This has been one of the factors that enabled the "green revolution", i.e., the considerable increase in food production obtained from the same area of land with the help of fertilizers, more efficient machinery, intensive irrigation and more effective pest management (UNU, 2003). Worldwide, total expenditures on pesticides increased 61% between 1999 and 2009, from $1.1 billion to $1.9 billion. The global pesticide market was around $44 billion in 2011 and projected to increase 2.9% per year to $48 billion in 2014 (UNEP, 2011; The Freedonia Group, 2012b).

According to Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) (2016), world pesticide production shows a steeply increasing trend from 1940 to 2015 (Figure 1.1). For example, total pesticide production has increased from one million metric tons in 1965 to nearly two million metric tons in 2000 (Carvalho, 2006; Pimentel, 2009). By the mid-1990s, developing countries consumed approximately 25% of all pesticides; 13% of this consumption occurred in Asia, 8% in Latin America, and 4% in Africa. Approximately 75% of global pesticide consumption occurred in developed countries (Schaerers, 1996; Brodesser et al., 2006; Aktar et al., 2009). The consumption of pesticides has been increasing dramatically over the last 3-4 years at a 6% rate and is likely to reach $64 billion by 2017. In terms of its volume, the global market for pesticides is projected to reach 3.2 million tons by 2019 compared to 2.5 million tons in 2015. In the EU alone, more than 200,000 tons of pesticides (active ingredients) are used annually (Pesticide action network (PAN)-Germany and PAN EU, 2012). Most of the pesticides worldwide are used to protect fruit and vegetable crops, but in developed countries, pesticides are mostly used for maize (PAN-Germany and PAN EU, 2012; Pimentel, 2009).

World Pesticide Market Report (2011) says that the large and established markets of North America and Western Europe are expected to post below-average growth in the coming years, mainly due to market maturity and efforts to limit unnecessary usage of pesticides (such as restriction of commercial and consumer pesticide application in some Canadian municipalities). The same sluggishness is expected for the large, developed Japanese market. The emerging agricultural powerhouse is in South America. Brazil, already one of the world's most potent agricultural producers, is expected to post growth well above the regional average, which itself is substantially faster than the global growth average. The pesticide markets in Africa and parts of the Middle East will also register strong growth, but much of the region will remain substantially underdeveloped as a market for synthetic pesticides.

2.1.3.2. Ethiopian pesticides production and market

Up until 1998, all pesticides in Ethiopia were imported from abroad. Since then APF has come to the picture. The current market share of APF in the domestic market is about 27% out of the total pesticides market (APF, 2015).

Ethiopia has no industry to produce active ingredients and only one local pesticide formulating company, Adamitulu Pesticide Company. This company uses imported active ingredients and solvents to formulate a portion of the pesticides required in Ethiopia. Between 2000 and 2012, the company produced 17,662 metric tons of pesticides for agricultural and public health purposes. Of this production, public health products for vector control accounted for a significant share: 8,858 metric tons (MoA, 2013). During these years, 32,230 metric tons of agricultural pesticides were imported (see chapters 2 & 3). The pesticide market is therefore heavily dependent on imports by local agents representing international manufacturing/formulating companies (MoA, 2013).

The domestic pesticides market is highly competitive due to the nature of supply and demand nature. The supply side is characterized by technical grad manufacturer. On the demand side a single pest could be treated by several technical compound and the total options available to the buyer could be more than one. Whereas most of the imported products are produced by large companies who can develop the technology. APF only in formulating products based on recipes purchase from others (APF, 2010)

2.1.3.3. Underlying Factors Affecting Operational Productivity

There are several factors affecting operational productivity. Generally, they are quality, management, technology, capital, human resource and ergonomics or safety issues (stevenson, 2009).

2.1.3.3.1. Quality and Operational Productivity

The quality of a product or service may be defined as the measure of the magnitude to which it satisfies the customer (Gilgeous, 1997). Chase et al (2009) refer to the term quality as “make a great product or deliver a great service”, while Brown et al (2005) define quality as “the total composite product and service characteristics through which the product or service in use will meet the expectations of the customer.” Gower (1994) defines quality as conformance to specifications, meeting the customers’ expectations, supply of goods which do not come back to customers who do. He also adds that quality is giving the customer what he wants today, at a price he is afford to pay, at a cost he can contain, again and again and again, and giving him something even better tomorrow. It is the degree of conformance between expectation and realization.

As a part of their strategy for quality, the best organizations strive for continuous improvement (Stevenson, 2009). Continuous improvement can be attained by using a lean system approach which in turn leads to continuous improvement in quality. This approach to process improvement is termed "Kaizen". The key to Kaizen is the understanding that excess capacity or inventory hides underlying problems with the processes that produce a service or product. Lean systems provide the mechanism for management to reveal the problems by systematically lowering capacities or inventories until the problems are exposed (Krajewski et al., 2007).

The consequences of poor quality mean that problems have to be sorted out which takes up managements time. The result is that more mistakes could be made and the process becomes more unreliable. On the other hand, if more things are done right first time, less time has to be spent on correcting mistakes. This in turn leads to operations being more stable, more productive, efficient and dependable (Gilgeous, 1997).

One reason that the competitive position of a firm can falter is that the quality of goods and services produced does not meet the customers" expectations. When quality is poor, demand for products and services can diminish quickly. There is a clear relationship between quality and productivity. Generally, when quality increases, so will productivity because waste is eliminated. The amount of inputs required to produce outputs is reduced and so productivity increases (Adam and Ebert, 1998).

2.1.3.3.1.1. Standardization

Products, processes and procedures whenever possible should be standardized to reduce variability. This can have a significant benefit for both productivity and quality. By eliminating process variability, the probability of a quality failure (as well as the probability of a safety event) is minimized. The productivity enhancements are directly related to the elimination of product loss (Maudgalya T., 2008).

Product standardization in particular proposes benefits to customers and producers alike. Customers can consider simplicity and convenience in purchasing standardized products. In designing new products, standardization can boost productivity by avoiding unnecessary engineering design, when a suitable component already exists; simplifying materials planning and control during production because fewer components are in the system and finally reducing components production (if the components are produced in - house) or reducing purchasing requirements and limiting the number of retailers (Adam and Ebert, 1998).

2.1.3.3.1.2. Design of Work Place and Scrap Rate

Design of the work place can affect productivity, having tools and other work items within easy reach can positively impact productivity. Work stations should be designed in such a way as to ease motions, reaches and travel distances of a job. Scrap rate also adversely affect productivity, indicating inefficient use of resources.

2.1.3.3.2 Management and Operational Productivity

Management can be defined as a process by which a cooperative groups direct actions towards common goals. Hence, management needs techniques by which a distinct group of people (managers) organizes activities of other people; managers rarely perform the activities themselves. In general the word management refers to a special group of people whose job is to direct the efforts and activities of other people towards common objectives (Massie, 2004).

Management is responsible for ensuring that labor and capital is effectively used to enhance productivity. Improvements can make through the use of knowledge and the application of technology. This in turn needs persistent education and training. These are high cost items that are the responsibility of operations manager to shape workforce of an organizations. Poorly educated labour is a second-class input and a country cannot become globally competitor with second-class inputs (Heizer& Render, 2008).

2.1.3.3.2.1. Role of Management in Productivity Improvement

The way processes are managed plays a key role in productivity improvement. Managers must inspect productivity improvement and must examine productivity from the level of the value chain because it is the collective performance of individual processes that make the differences. The challenge is to increase the value of output relatives to cost of input. If processes can generate more output or output of better quality, using the same amount of input, productivity increases. If they can keep the same level of output, while reducing the use of resources, productivity also increases (Krajewski, et al 2007).

2.1.3.3.3 Technology and Operational Productivity

Technology may be defined as the process used to change inputs into outputs; the application of knowledge to perform work; the theoretical and practical knowledge, skills, and artifacts that can be used to develop products as well as their production and delivery system. In general, we can define technology as the practical implementation of learning and knowledge by individuals and organization to aid human endeavor. Technology is the knowledge, products, processes, tools and systems used in the creation of goods or in the provision of services. Further, technology may be classified into various categories, which include product and process technology, mechanization and information technology (White & Brutan, 2009).

Technology is one of the crucial dimensions for managing operations and change. Technology influences productivity improvement extensively. It is a combination of processes and technology in terms of equipment and hardware through which a product or service is produced or delivered. It has been found that technology-based businesses contribute more to the international exports than other types of businesses. Technology helps push firms to lower costs (White & Brutan, 2009).

Technology has played a dominant role in the productivity growth of most nations and has provided the competitive advantage to firms that have adopted it early and implemented it successfully. Although the various manufacturing and information technologies is a powerful tool by itself and can be adopted separately their benefits grow exponentially when they are integrated with each other (Chase et al.,2007).

Implementing flexible manufacturing systems or complex decision support systems requires a significant commitment for most firms. However, as technologies continue to improve and are adopted more widely, the nature of these technologies, the total commitment of top management and all employees is critical for the successful implementation of these technologies (ibid).

2.1.3.3.3.1. Product and Process Technology

Product technology involves a series of engineering activities to develop a detailed definition of the product, including its subsystems and components, materials, sizes and so on. It ends with design that meets several design objectives (Adam & Ebert, 1998).

2.1.3.3.3.2. Technology

Local manufacturers tend to have low productivity and they are weak in terms of competition which is the result of using non advanced technology, not maximizing machinery utility and not improving in technology due to the limitation of funding and most are mainly users of technology, not adaptors of technology (OSMEP, 2007 a). Although, the pesticides industry needs advanced technology and new innovation. Many managers are not aware of applying the accurate technology in their business and they do not have the ability to choose appropriate technology for their business. The World Bank (2009) claims that investments in technology are required in order to build up existing capacity and to improve the quality and productivity of production which will generate in higher value-added products that will improve the competitiveness for firms.

2.1.3.3.3.3. Information Technology (IT) and Productivity

IT helps in removal of waste in terms of organizational resources as it helps to reengineer processes and eliminate waste in business processes. Processes are improved and are done within a shorter time. Manual business processes become automated with the introduction of IT and boost service delivery or production of goods and increasing the overall efficiency of the organization (Targen, 2002).

IT is considered as a fundamental factor of production. Its role as an important organization resource just like land, capital and labor .All levels of the organization need it for planning at strategic level, for control at the supervisory level, and for operational management on a day to day level. It is needed by organizations for purposes of planning, control, and coordination. The proficiency, timeliness and accuracy of factual information at the disposal of the manager, can give a business a considerable advantage over its competitors, and increase the organization’s performance and productivity (Ochieng, 2009).

Use of internet can lower costs over a wide range of transactions thereby increasing productivity. It is likely that this effect will continue to increase productivity in the anticipated future (Stevenson, 2009). The internet has transformed marketing and business since the first website went online in 1991. With over one billion people around the world regularly using the web to find products then consumer behavior and the way companies market to both consumers and businesses have changed dramatically (Johnson et al., 2009).

The social networking sites (SNS) can also serve as a very effective and cheap platform for advertising and resulting in a dramatic increase in sales. This in turn may lower cost of production and lead to increased productivity (Stevenson, 2009).

2.1.3.3.4. Capital and Operational Productivity

The procurement of new production equipment, the upgrade of existing production equipment and the financing of day-to-day manufacturing operations requires a heavy capital investment (Morrison, 1998). The measurement of capital is perhaps the most problematic of inputs to measure (ibid). This is also referred to as total factor productivity, which is defined as the ratio of a measure of total output quantity to a measure of the quantity of total input (Mark, 1998).

2.1.3.3.5. Human Resource and Operational Productivity

2.1.3.3.5.1. Lack of skilled labour

Lack of skilled labour is a hampering factor for local manufacturer in developing countries (Sleuwaegen and Goedhuys, 2002). APO (2001) highlights lack of skilled labour as one of the most crucial obstacles for manufacturer. Thus, it is difficult for the company to attract highly educated workers and retain skilled employees (high labour turnover) since they prefer to work for LEs that can offer higher salary, job security and career possibilities, resulting in a slowdown in workforce development which has a negative impact on the quality of goods and services (OSMEP, 2007 a).

2.1.3.3.5.2. Incentives Plan, Layoff and New Workers and Productivity

These can increase productivity. This is supported by Vrooms expectancy theory that maintains that people will make an effort to achieve a standard of performance if they notice that it will be rewarded by a desirable outcome. This factor also receives support from the motivation theory which says among other things that individuals work harder if given specific rewards for good performance (Wilson, 2005). It is noteworthy that the best companies pay good wages and salaries in relation to the surrounding labour market and generally offer both company – wide bonuses and performance - related individual wages (Hornell, 1994).

2.1.3.3.6. Ergonomics/Safety and Operational Productivity

Operational productivity mainly influenced by motions, extents and travel distances of a job within a work station. Large travel distance of a job within a workstation has a negative impact on operational productivity. Searching for lost or misplaced items largely as a result of poor design of work station affects productivity negatively. Accidents can take a peal on productivity. Poor safety conditions have been shown to greatly affect productivity and quality. The case studies analyzed in the research on whether emphasis on safety approach actively contribute to existing productivity and quality level clearly indicated a link between safety as a business objective and increased levels of production, quality, and cost efficiency (Maudgalya, et al., 2008).

2.1.3.3.6. Research and development (R&D) - Innovation

The impacts of globalization have pressured local manufacturers in developing countries to greater demands (Raymond and St-Pierre, 2004). Particularly in the manufacturing sector, local manufacturer are facing a pressure to increase R&D, innovation and quality. Innovation relies on bringing together different types of research and utilizing this knowledge to design new products, thus, innovation increasingly depends on links between scientific research and industrial R&D and without an R&D focus, companies risk falling behind competitors in innovative new products (Morrison, 2006).

Normally developed countries allocate about 3% of GDP to R&D activities. Some developing countries, including China, India and Brazil, have rapidly increased their R&D expenditure, to levels with those of the world's most developed countries (Morrison, 2006). Thus, there is a need to increase government subsidies in terms of R&D support in order to gain competitive advantage over foreign competitors (OSMEP b, 2007; Morrison, 2006).

2.2 Empirical Literature Reviews

Different research has been carried out concerning elements that affect operational productivity of one of a kind enterprise in different countries. Even though frequent settlement is lucking on how unique elements are related to productivity, some of these researches are described below.

Bloom, Benn, Aprajit and John. (2013) conducted a study on "Why Do Firms in Developing Countries Have Low Productivity?" and try to examine whether managerial skill explains productivity differential among Indian textile firms using a randomized field experiment. The researchers provided free consulting on management practices to randomly chosen treatment plants and compared their performance to a set of control plants. Their finding shows that adopting these management practices "raised productivity by 17% in the first year through improved quality and efficiency and reduced inventory, and within three years led to the opening of more production plants.

Raggl (2015) carried out a study on "Determinants of total factor productivity in the Middle East and North Africa" and examined the relationship between human capital and total factor productivity in the Middle East and North Africa region covering the period between1980 and 2009. His findings were suggested that human capital plays an important role in changing the efficiency in which existing input factors are used. The author emphasized the need to achieve certain threshold level of educational attainment if domestic innovations are to be efficient.

Srivastava & Patel (1990) in their studies of analysis of operational productivity of pesticides formulator in the case of India, they found that Technology and Capital have an impact on the productivity of India pesticides formulator companies in their business. Besides this the sectors needs qualified human resource for the company's successfulness and in utilizing the resources efficiently. Francis (2010) has made a study on "factor affecting operational productivity of small and medium size manufacturing industry in Kenya". This study sought to establish the factors affecting the operational productivity of the small and medium sized manufacturing firms in Kenya and to establish the challenges facing small and medium sized manufacturing firms in achieving optimal operational productivity. Analysis of the factors indicated that quality, human resource issues, management and technology related issues had a strong effect on operational productivity. On the other hand, capital and ergonomics/safety had a small to very small effect on operational productivity.

TAK-IRDI (2016) they carried a study In order to provide an overview of investment opportunity in the production and marketing or agro-chemicals in Ethiopia a desk review and in-depth discussions were conducted. Based on these inputs the study identifies the followings. Supply chain analysis reveals that high capital requirement, high transportation cost, lack of adequate market information and a long domestic supply chain characterize import and distribution of major agro-chemicals in Ethiopia.

Lieberman, M & B (1990) carried out a research on firm–level productivity and management influence showed that changes in top management were followed by significant shifts in the level of growth rate of total factor productivity. More generally, the results suggested that management effects rather than country-specific factors are the major sources of productivity difference among manufacturing companies.

Tsegay (2018) carried out a study on "productivity determinant in the manufacturing sector of Ethiopia evidence from textile and garment industries." The study aimed at exploring the determinants of productivity using a census data of medium and large firms in the textile and garment industries in Ethiopia. The study revealed that labour and material inputs drive firm level outputs while the elasticity of output to capital input is weak.

Birhanu & Kibret (2002) in their studies of declining productivity and competitiveness in the Ethiopian leather sector try to compare labor productivity of Ethiopian tanning sub sector with different countries. They found that Ethiopian's labor productivity is better than that of China and lower labor productivity than Taiwan. This entails that Ethiopian's tanning sub sector is competitive than China but less competitive than that of Taiwan. Furthermore, they compare labor productivity of Ethiopian footwear subsector with Tunisia. The result indicates that Ethiopian labor productivity was lagging behind that of Tunisia. This implies Ethiopian's footwear sub sector is less competitive than that of Tunisia.

Bigsten & Gebreeyesus (2009) made a study on the relationship between export and firm productivity using firm-level panel data for the Ethiopian manufacturing sector and reported that productivity appears to be strongly associated with exporting. They concluded that exporting firms pay higher wages, have more workers and have more capital per worker.

Nega & Moges (2002) carried out a study on productivity and competitiveness of the Ethiopian leather sector argued that competitiveness cannot be ensured by having large resource endowments nor does lack of technological capacity explains competitiveness. Irrespective of availability of abundant labor resources, they found the Ethiopian leather sector to be uncompetitive. In the study, labor productivity and total factor productivity of the tanning and footwear industries were found to be small and comparable to the TFP of other developing countries two decades back. The researchers identified factors such as lack of improvement in the management of firms, selection of inputs, timely maintenance provision, efficiency in the supply and stock holding of raw materials, and supply of utilities as the reasons for the worsening TFP.

From the above empirical findings the researcher can conclude that determinant factors of productivity have generated varied results ranging from those supporting a positive relationship among the variables used in the study to those opposing it. Therefore, this study was initiated to investigate the factors affecting operational productivity of the pesticides industry by taking Adamitulu pesticides factory as the case.

2.3. Conceptual Framework

The conceptual framework is crafted from the theoretical and empirical literatures reviewed in this study.

Quality: quality can be defined as meeting the requirements of the customer, conformance to specification and supply of products which do not come back to the firm. There is a clear relationship between quality and productivity, when quality of product increases productivity also increases because waste is eliminated during production process.

Management: defined as a process in which a group of people direct actions towards a common goal. It also includes activities of setting the strategy of a company and controlling the efforts of its employees to accomplish its objectives through the utilization of available resources. Management is responsible for ensuring that labour and capital is effectively used to improve productivity.

Technology: is a knowledge, process, system and product used in the production of goods and services and also it is a practical implementation of learning and knowledge by organization to aid human endeavor. Technology has played a dominant role in the productivity growth and has provided a competitive advantage to firms that have adopted it early and implemented it successfully.

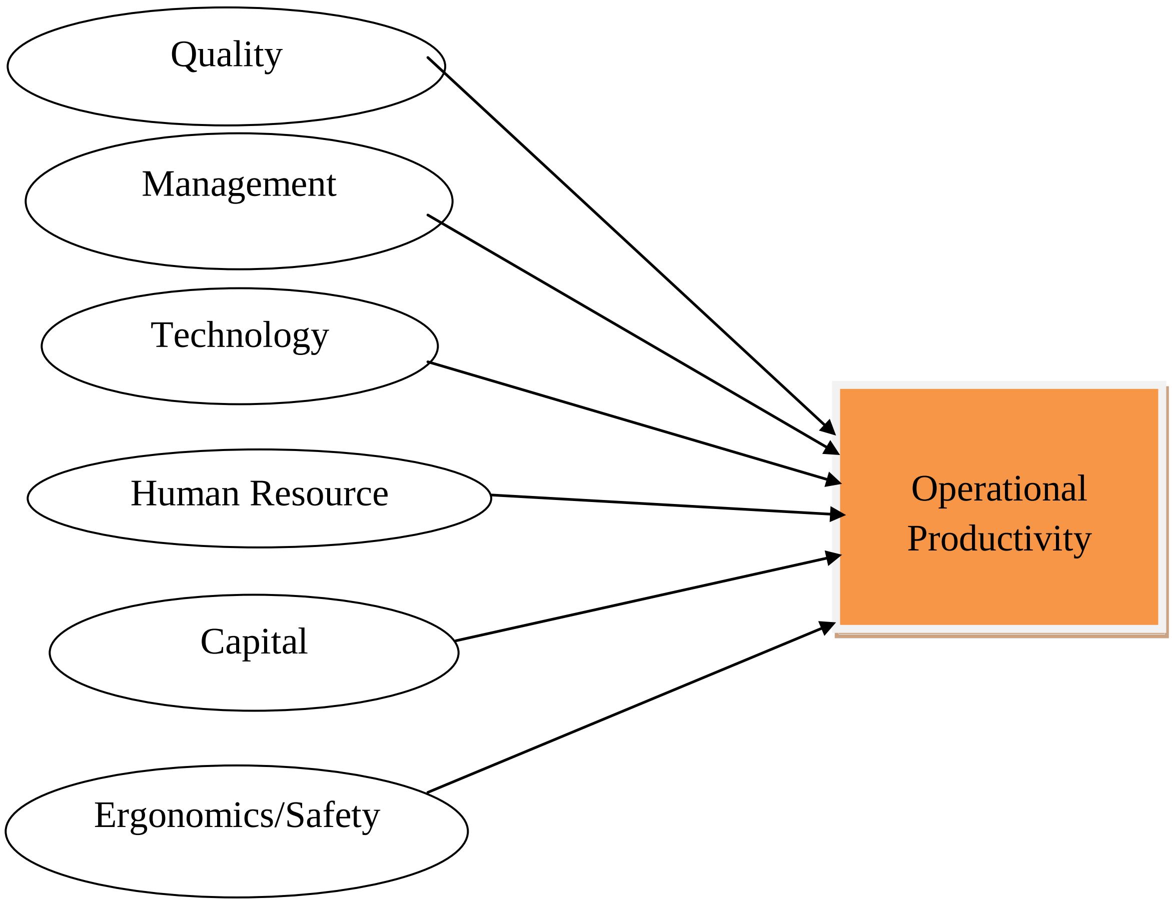
Capital: is a resource measured in terms of money used by firms to make products or to provide their service to the sector of the economy upon which their operation is based. Investing capital on acquisition of production equipment or upgrading of the existing is essential for improvement of productivity.

Human resource: describe both the people who work for the organization and the department responsible for managing resources related to employees. Labour Skill, knowledge and incentive mechanisms are critical for enhancing productivity at firm level.

Ergonomics/Safety: ergonomics deals about interactions between people and their physical and organizational environments. When people's workplace conditions and job demands match their capabilities, safety and productivity improve. The conceptual framework which guides the study is as presented below.

Based on the above reviewed theoretical and empirical literatures the main knowledge gap is the absence of research findings on factors affecting operational productivity of the pesticides industry in Ethiopian. This study was aimed to address gaps mentioned above by examining specific factors that can influence the operational productivity Adamitulu Pesticides Factory.

Figure 2.1 Conceptual Framework



Source: Adopted from Stevenson (2009)

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter presents research design and Approach, data type and source, data collection instrument, sampling design and size, data analysis techniques and ethical consideration.

3.1. Research Design and Approach

Explanatory research identifies cause and effect of an event. It is the first choice to deal with the nature of relationship between independent and dependent variables with the help of testing hypothesis, which gives understanding about the relationship between variables (Babbie & Mouton, 2010). Therefore, this study were used explanatory research design since the main aim of the study was to investigate factors that affect operational productivity of local pesticides manufacturer by taking the case of Adamitulu pesticides factory by exploring the relationship between the dependent variable (operational productivity) and the independent variables: management, technology, human resource, capital, quality, and ergonomics/safety issues.

As said by Kothari (2004), there are two basic approaches to research, the qualitative approach, and quantitative approach. The former approach to research is concerned with narrative or in-depth information. Whereas the latter involves the generation of data in a quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. For the purpose of doing rigorous statistical analysis, a quantitative approach was selected.

3.2. Population, Sample Design and Procedures

The population is all individuals of interest to the research. The target population for this research study was employees of APF, which includes junior officers to top level management leaders of the company. The main activities of the company are performed by the following departments: Production and Technique, Finance, Purchasing, Human resource management, Research and Development, Marketing and Quality assurance. The total numbers of employees under these job families are around 170.

The study was used stratified random sampling techniques to carry out this research. Since the sample is picked from the different departments, it has given a better representation of the population, so it was reduced bias on any one given area called department with higher population has more respondents. Since the number of employees in each cluster is not the same, the researcher had applied a proportionate sampling to the size of each cluster that was, to determine the number of employees from each strata. The proportion of each strata's employees in relation to the total number of employees has been considered. Thus, from the seven strata a proportionate sampling was performed to reach the desirable sample from each strata.

Sample Size Determination

Sample size represents the number of items selected from the population (Kothari, 2004). A good sample size depends on three key factors namely; the level of confidence desired the margin of error and the variability of the population. Seven of job departments aka strata's were chosen and simple random sampling was used to get sample from each strata. Out of the total population unit of 170 employees and management members, the manufacturing department accounts 50, finance accounts 15, Procurement and store accounts 12, human resource management accounts 30, research and development accounts 10 and marketing accounts 25, and 28 employees from sales department. Therefore, for this study, in order to determine the number of sample from the units of population, the formula from the book of Kothari (2004) was used for the finite population. This sampling method was also used by (Abraham Redi, 2017); (Jemal Esleman, 2019). Accordingly, the minimum sample size is

$n = (Z^2 . P (1-P). N) / (e^2 (N-1) + Z^2 . P (1-P))$

Where n is sample size,
N is total population size,
P is estimated variability in the population,
Z is standard error associated with a chosen level of confidence and
e is the acceptable errors.

Hence, the sample size of APF employees were determined in accordance with the following assumptions:
Probability (P) equals to 50%, this is the safest possible assumption, the confidence level of 95% which corresponds to Z -value of 1.96 and an error or precision (e) of 5% and N is 170 from 7 job departments. Given the above assumption, the sample size is estimated by:

$n = (Z^2 . p (1-p).N) / (e^2 (N-1) + Z^2 .p (1-p)) =$

$n = 1.96^2 (0.5) (1-0.5) (170) / (0.05)^2 (170-1) + 1.96^2 (0.5) (1-0.5) = 118.$

Therefore, the minimum sample size for the study was used 118. A proportion of sample respondents to selected job departments will be 170/7=24, which means on average 24 respondents was selected on each job department.

Table 3.1: Stratified Sample Size Determination

No.	Type of Strata	Population (A)	Population Proportion (B)= (A/Total Population)	Sample Proportion= (B*Total Sample)	Sample Size
1	Production and Technique Department.	50	29%	29%*118	34
2	Finance Department	15	9%	9%*118	11
3	Procurement and store Department	12	7%	7%*118	8
4	Human Resource Management Department	30	18%	18%*118	21
5	Research and Development Department	10	6%	6%*118	7
6	Marketing Department	25	15%	15%*118	18
7	Quality assurance Department	28	16%	16%*118	19
Total		170	100%		118

Source: Own Computation (2020)

Finally, simple random sampling procedure with lottery method was used to collect data from the sample of 118 APF employees/respondents. Thus, in the selected job departments, questionnaires were distributed to those employees using simple random sampling technique.

3.3. Data Type and Source

This study was used quantitative data type collected from primary sources. The primary data were collected through structured questionnaires that were distributed to selected sample population.

3.4. Data Collection Instruments

In this study, the primary data was collected from the employees of APF through structured questionnaire prepared for this purpose. The questionnaire was divided into two sections. The first section contained the general information on characteristics of the respondents were requested to provide information about their level of education, position, gender, address, current legal status and positions.

The second section of the questionnaire was designed to enable the researcher to gather information about the factors affecting operational productivity of APF. For all the questionnaires included in section two, the respondents were requested to indicate their feeling on a five point Likert scale type to measure weighted as follows: 1=Very small extent, 2=small extent, 3=neutral, 4=large extent, and 5= very large extent. But, while making interpretation of the results of frequency and mean the scales are reassigned as follows; 1.0 -1.80 = Very small extent, 1.81 –2.60 = Small extent, 2.61 –3.40 = Neutral, 3.41 –4.20 = Large extent and 4.21 – 5.00 = Very large extent (Best, 1977).

3.5. Data Analysis Procedure

Data analysis was done to understand data nature, important relationships between variables, effect of independent variables on dependent variable, and draw inferences from the data in the study. All these were identified by statistical tools such as descriptive and inferential statistics.

Descriptive statistics such as mean, frequency and percentage were used in this study to explore and present an overview of the demographic variables.

With regard to inferential statistics, regression analysis was used to test the significance and contribution of each independent variable to the dependent variable to investigate the relationship between independent and dependent variable.

The model, which was used in this research was used multiple linear regression model using SPSS to aid the researcher in the analysis of the data. The Model is shown below:

$Y_i=f(x_i)$ …………………………………………………………..(1)

Where, Yi = *summative likert scales* of the dependent variable which is operational productivity and Xi = *summative likert scales* of the independent variables. By taking all explanatory variables in to consideration:

$$OP = f\,(Q, M, T, K, HR, E/S)$$

$$OP = \beta_o + \beta_1 (Q) + \beta_2 (M) + \beta_3 (T) + \beta_4 (HR) + \beta_5 (K) + \beta_6 (E/S) + \varepsilon i$$

Where OP = operational productivity,βo = constant, Q = quality, M = management, T = Technology, HR = Human Resource, K = Capital, E/S = Ergonomics/Safety, β1, ….. , β6 = Coefficient of Independent Variables, εi = Error Term.

3.6. Validity and Reliability of Instruments

The reliability test is an important instrument to measure the degree of consistency of an attribute which is supposed to measure. As stated by Mahon & Yarcheski (2002) the less variation of the instruments produces in repeated measurements of an attribute the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool.

Cronbach's alpha is one of the most commonly accepted measures of reliability. It measures the internal consistency of the items in a scale. It indicates that the extent to which the items in a questionnaire are related to each other. It also indicates that whether a scale is one dimensional or multidimensional.

The normal range of Cronbach"s coefficient alpha value ranges between 0-1 and the higher values reflects a higher degree of internal consistency. Different authors accept different values of this test in order to achieve internal reliability, but the most commonly accepted value is 0.70 as it should be equal to or higher than to reach internal reliability (Hair et al., 2003). Thus, for this study, a Cronbach's Alpha score was .832 which indicates higher internal reliability and increases the quality of the research.

Table 3.2. Reliability Statistics

Variables	Numb. scale	Cronbach's Alpha	Decision rule
Operational Productivity (Y)	7	.862	Accepted
Management issue	5	.763	Accepted
Technology issue	6	.852	Accepted
Human resource	6	.921	Accepted
Capital	4	.721	Accepted
Quality	6	.858	Accepted
Safety Issue	4	.857	Accepted
Overall Reliability	38	.832	Accepted

Source: SPSS Computation (2021)

3.7. Methods of Data Analysis and Presentation

The researcher used descriptive and inferential statistics. The perception of APF employees were analyzed using descriptive statistics while the variables of interest (scale responses) were analyzed using explanatory factor analysis and multiple linear regression using statistical package for social science SPSS 24 software to understand and examine the causal relationship of the variables.

3.3 Variables and their Measurements

Table 3.3 Variables and Measurements

Variables	Measurements
Dependent variable	
Operational productivity (OP)	Summative likert scales value on perceptions of respondents on improved quality of products, reduced cost of operation, Increased employees productivity, Increased production efficiency, Reduced delivery time of product for market and Frequently produce new products aspects of of Adamitulu pesticides factory.
Independent Variables	
Quality issues (Q)	Summative likert scale values on perceptions of respondents on the level of, frequency of returned (rejected) products, Product characteristics such as functionality (feature), reliability (consistency), and aesthetics, frequency of defective products, the availability of standard operating procedures (SOPs) (e.g. work processes) for each major operation/process.
Management issues (M)	Summative likert scale values on perceptions of respondents on Planning of production activities (work activities are planned to balance material availability, manpower, machine availability, and workload between operations), Co-ordination of production activities, Supervision of staff in the production department, Supervision of staff in the production department, Control of production materials and the availability of support from the top management to understand problems and root causes before acting.
Technology issues (T)	Summative likert scale values on perceptions of respondents on the existing processing technologies level, the level of automation of production work, the product design technology, the availability of technology for new product and formulation type, using of computers in production process and The availability of an effective planned preventive maintenance system.
Capital (K)	Summative likert scale values on perceptions of respondents on the availability of capital for purchase of raw material and packing material, availability of capital for purchase of genuine spare parts and other accessories, availability of capital for production operations and availability of capital for upgrade of equipment like production process line and packing machine.
Human resource issues (HR)	Summative likert scale values on perceptions of respondents on the incentives to employees (bonuses and pay increments) for exceeding set production levels, The total number of hours employees worked, Layoffs which include retrenchment, downsizing and casualization, the skills of workers employees are encouraged to seek support from their supervisors when something goes wrong at work and Employee turnover.
Ergonomics/Safety issues (E/S)	Summative likert scale values on perceptions of respondents on the occurrence of accidents in the production department, motions, reaches and travel distances of a job within a workstation, Searching for lost or misplaced items, the unavailability of protective devices (gloves, goggles, boot, and mask) and the unavailability and inaccessibility of medical facility treatment.

3.8. Ethical Consideration

One very important consideration a researcher must not overlook is the issue of ethics in research. The researcher in accordance with this took steps to make sure that no respondent or any participant in this research work was harmed in any way. The researcher made sure that permission was sought and the aims and objectives of the study made known to the respondents through introductory letters and cover letters respectively. Respondents were also assured of the fact that the study is only for the purposes of academics and not for any other dubious use. Participants were also not forced but rather encouraged to voluntarily participate. The researcher also made sure that personal or demographic information were kept confidential.

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSIONS

4.1. Introduction

The findings of the study are presented in four parts. The first part presents the descriptive analysis of different variables under consideration. The second and the third parts presents findings obtained from factor and regression analyses respectively, while the fourth part presents hypothesis-testing results.

4.2. Sample Response Rate and Test of Outliers

The samples taken for the survey were 118 respondents and out of this, 115 questionnaires were returned. This means that the overall response rate is 97.5 percent.

Test for outliers are conducted to check whether any outlier exists or not in the data. SPSS defines data points as outliers if they extend more than 1.5 box-lengths from the edge of the box plot (Julie, 2011). Two (2) cases which have more than 1.5 box-lengths from the edge of the box plot in SPSS have found and thus excluded from further analysis (see Appendix 2A & 2B). Therefore, 113 cases, which are 96 percent of the sample size, found to be valid for further statistical analysis.

4.3. Demographic Characteristics of the Respondents

From the total of valid responses, male respondents 90 (78.26%) of the respondents while female respondents constitute 25 (21.74%).

The survey result shows that 22 (19.13%) of the respondents have TVET diploma, whereas 73 (63.48%) degree holder, master's degree 20 (17.39%), none from Ph.D. holder.

As far the experience of survey respondents is concerned 18 (15.65%) have served 1 to 3 years (less than 3 years), 36 (31.3%) are for 3 to 5 years (including 5 years). On the other hand, 27 (23.48%), are 7 to 10 years (including 10 years). The rest 34 (29.57%) are for more than 10 years. Relatively more than half of participants (53.07%) are for more than 5 years which in turn gave relatively better opportunity to elicit analyzable information and data on factors affecting operational productivity of APF.

Most of the respondents 76 (66.08%) involved in this study were subordinate and followed by the middle level managers 30 (26.09%) and the rest 9 (7.83%) were top level manager.

Table 4.1 summarizes the profile of the respondents.

Table 4.1: Demographic characteristics of the respondents

Question		Frequency	Percent
Sex	Male	90	78.26
	Female	25	21.74
Education	TVET	22	19.13
	Bachelor degree	73	63.48
	Masters	20	17.39
	PhD	0	0
Service year	1 to 3 years (less than 3 years)	18	15.6
	3 to 5 years (including 5 years)	36	31.3
	7 to 10 years (including 10 years)	27	23.48
	>10 years	34	29.57
Managerial position	Subordinate	76	66.08
	Middle level Manager	30	26.09
	Top Manager	9	7.83

4.4. Descriptive statics of variables affecting operational productivity

The factors were grouped into six categories according to how they relate to the six constructs under study i.e., management, technology, human resource, quality, capital and ergonomics/safety. This part presents the descriptive analysis based on a 5-point scale (Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5). However, for the sake of clarity and simplicity in interpreting the results, the mean value of the scales were reassigned as follows; 1.0 -1.80 = Very small extent, 1.81 –2.60 = Small extent, 2.61 –3.40 = Neutral, 3.41 –4.20 = Large extent and 4.21 –5.00 = Very large extent (Best, 1977) as cited by (Yonas, 2013).

4.4.1. Quality Issues Affecting Operational Productivity

Quality is one of the key issues that can affect operational productivity. The respondents were asked to indicate the extent to which operational productivity has been affected by quality in the APF on a five-likert scale.

Table 4.2: Quality Issues Affecting Operational Productivity

Factors	Response	Frequency	Percent	Mean
The level of scrap (a fragment left after production).	Very small extent	0	0	4.76
	small extent	0	0	
	Neutral	7	6.08	
	Large extent	20	17.39	
	Very large extent	89	77.39	
Frequency of returned (rejected) products.	Very small extent	0	0	4.88
	small extent	0	0	
	Neutral	0	0	
	Large extent	14	12.17	
	Very large extent	101	87.83	
Product characteristics such as functionality (feature), reliability (consistency), and aesthetics.	Very small extent	0	0	4.7
	small extent	0	0	
	Neutral	10	8.7	
	Large extent	18	15.65	
	Very large extent	90	78.26	
Conformance (meet) to specifications of products.	Very small extent	3	3.45	4.36
	small extent	4	3.48	
	Neutral	16	13.91	
	Large extent	18	15.65	
	Very large extent	74	64.35	
Frequency of defective products.	Very small extent	0	0	4.6
	Small extent	0	0	
	Neutral	12	10.43	
	Large extent	18	15.65	
	Very large extent	89	77.39	
The availability of standard operating procedures (SOPs) (e.g. work processes) for each major operation/process	Very small extent	15	13.04	3.64
	small extent	15	13.04	
	Neutral	16	13.91	
	Large extent	21	18.26	
	Very large extent	49	42.61	
	Grand Mean			4.49

Source: Own Field Survey (2021)

As can be seen in Table 4.2, Frequency of returned (rejected) products. (4.88) is the main determinant factors for quality issues. In which 87.83 % respondents have believed that this factor have Very large extent effect on the quality issue. There are also factors which to the very large extent to the large extent affects with quality issues: product characteristics such as functionality, reliability, and aesthetics (4.7); Frequency of defective products (4.6), frequency of defective products (4.6), and Conformance(meet) to specifications of products (4.36).

The overall mean of quality issues revealed to be 4.49. This also indicates that the majority of the respondents tend to believe that quality issues are important for operational productivity. Generally, when quality increases, so will productivity. Because waste is eliminated and the amount of inputs required to produce outputs is reduced (Adam & Ebert, 1998).

4.4.2. Management issues Affecting Operational Productivity

Management is the second key issue that can affect operational productivity. The respondents were asked to indicate the extent to which operational productivity has been affected by management in the APF on a five-likert scale.

Table 4.3: Management Issues Affecting Operational Productivity

Factors	Response	Frequency	Percent	Mean
Planning of production activities.	Very small extent	1	.87	4.59
	small extent	2	1.74	
	Neutral	3	2.61	
	Large extent	31	26.96	
	Very large extent	78	67.83	
Co-ordination of production activities.	Very small extent	0	0	4.83
	small extent	1	.87	
	Neutral	3	2.61	
	Large extent	11	9.57	
	Very large extent	100	86.96	
Supervision of staff in the production department.	Very small extent	6	5.22	4.21
	small extent	8	6.96	
	Neutral	14	12.17	
	Large extent	15	13.04	
	Very large extent	72	62.61	
Control of production materials. (e.g. work processes) for each major operation/process	Very small extent	7	6.1	4.12
	small extent	10	8.7	
	Neutral	13	11.3	
	Large extent	17	14.78	
	Very large extent	68	59.13	
The availability of support from the top management to understand problems and root causes before acting.	Very small extent	6	5.22	4.2
	small extent	8	6.96	
	Neutral	14	12.17	
	Large extent	16	13.91	
	Very large extent	71	61.74	
	Grand mean			4.39

Source: Own Field Survey (2021)

Results in Table 4.3 show that Co-ordination of production activities. (4.83) in which 86.96 % of respondents believe it affects to the very large extent and Planning of production activities (4.59) have strong positive effects under the management issues. In addition, majority of the respondents indicate that management issues (mean value of 4.39) affected operational productivity to a large extent. Therefore, this result supports the report of Lieberman, et al, (1990) which suggested that management factors are the major source of productivity among manufacturing companies.

4.4.3. Technology Issues Affecting Operational Productivity

Technology is the third key issue that can affect operational productivity. The respondents were asked to indicate the extent to which operational productivity has been affected by technology in the APF on a five-likert scale.

Table 4.4 Technology Issues Affecting Operational Productivity

Factors	Response	Frequency	Percent	Mean
The existing processing technologies level.	Very small extent	0	0	5.00
	small extent	0	0	
	Neutral	0	0	
	Large extent	0	0	
	Very large extent	115	100	
The level of automation of production work.	Very small extent	7	6.1	4.28
	small extent	7	6.1	
	Neutral	8	6.96	
	Large extent	18	15.65	
	Very large extent	75	65.22	
. The product design technology.	Very small extent	4	3.4.	4.38
	small extent	6	5.22	
	Neutral	9	8.2	
	Large extent	21	18.26	
	Very large extent	76	66.09	
The availability of technology for new product and formulation type.	Very small extent	4	3.4	4.00
	small extent	8	6.96	
	Neutral	24	20.87	
	Large extent	25	21.74	
	Very large extent	54	46.96	
Using of computers in production process.	Very small extent	5	4.35	3.93
	small extent	9	8.2	
	Neutral	25	21.74	
	Large extent	26	22.61	
	Very large extent	50	43.48	
The availability of an effective planned preventive maintenance system.	Very small extent	2	1.74	4.47
	small extent	4	3.4	
	Neutral	6	5.22	
	Large extent	40	34.78	
	Very large extent	63	54.78	
	Grand mean			4.34

Source: Own Field Survey (2021)

Findings from Table 4.4 indicate that, the factory existing processing technologies level (5.00); in which 100% of the respondents believe it affects to the very large extent. The availability of an effective planned preventive maintenance system (4.47) is also one of the main determinant factors of technology issues. The factory product design technology (4.38) and the level of automation of production work (4.28). Based on the result, the average mean value of technology issues is 4.34 which indicate that technology issue affected operational productivity to a large extent.

The study findings concur with the results from a study by Targen (2002) which found that technology helps in elimination of waste in terms of organizational resources as it helps to re-engineer processes and eliminate waste in business processes. Processes are enhanced and are done within a shorter time. Manual business processes become automated with the introduction of technology and hence service delivery or production of goods is enhanced increasing the overall efficiency of the organization.

4.4.4. Human Resource Issues Affecting Operational Productivity

Human resource is the fourth key issue that can affect operational productivity. The respondents were asked to indicate the extent to which operational productivity has been affected by human resource in the APF on a five-likert scale.

Table 4.5: Human Resource Issues Affecting Operational Productivity

Factors	Response	Frequency	Percent	
Incentives to employees (bonuses and pay increments) for exceeding set production levels.	Very small extent	10	8.7	4.06
	small extent	10	8.7	
	Neutral	8	6.96	
	Large extent	22	19.13	
	Very large extent	65	56.52	
The total number of hours employees worked.	Very small extent	25	21.74	3.00
	small extent	25	21.74	
	Neutral	17	14.78	
	Large extent	19	16.52	
	Very large extent	29	25.22	
Layoffs which include retrenchment, downsizing and casualization.	Very small extent	23	20	3.09
	small extent	24	20.87	
	Neutral	17	14.78	
	Large extent	21	18.26	
	Very large extent	30	26.09	
	Total	115	100	
The skills of workers.	Very small extent	0	0	4.52
	small extent	3	2.61	
	Neutral	3	2.61	
	Large extent	43	37.39	
	Very large extent	66	57.39	
Employees are encouraged to seek support from their supervisors when something goes wrong at work.	Very small extent	6	5.22	3.95
	small extent	9	7.83	
	Neutral	17	14.78	
	Large extent	36	31.3	
	Very large extent	47	40.87	
Employee turnover.	Very small extent	4	3.4	4.17
	small extent	5	4.35	
	Neutral	13	11.3	
	Large extent	38	33.04	
	Very large extent	55	44.83	
	Grand mean			3.83

Source: Own Field Survey (2021)

Results presented in Table 4.5 indicate that, the skill of workers (4.52) is one of the main determinant factors of human resource issues among others did, in which 57.39% respond to a very large extent and 37.39% to a large extent. Employee turnover (4.17) and Incentives to employees (bonuses and pay increments) for exceeding set production levels (4.06) have a large extent effects. Layoffs which include retrenchment, downsizing and casualization (3.09) and the total number of hours employees worked (3.00) are reported to have a neutral relations with Human resource issues.

The average mean value of human resource revealed a result of 3.83 which means human resource had effects on operational productivity to a large extent. The findings by Sleuwaegen and Goedhuys (2002) indicated that the human resource is a key factor for operational productivity and success of a manufacturer which is in line with the finding of this study.

4.4.5. Capital Issues Affecting Operational Productivity

Capital issues are the fifth issue that can affect operational productivity. The respondents were asked to indicate the extent to which operational productivity has been affected by capital issues in the APF on a five-likert scale.

Table 4.6: Capital issues affecting operational productivity

Factors	Response	Frequency	Percent	Mean
Availability of capital for purchase of raw material and packing material,	Very small extent	34	29.57	2.26
	small extent	41	35.65	
	Neutral	20	17.39	
	Large extent	13	11.3	
	Very large extent	6	5.22	
Availability of capital for purchase of genuine spare parts and other accessories.	Very small extent	24	20.87	2.71
	small extent	33	28.7	
	Neutral	24	20.87	
	Large extent	20	17.39	
	Very large extent	14	12.17	
Availability of capital for production operations.	Very small extent	34	29.57	2.23
	small extent	41	35.65	
	Neutral	23	20	
	Large extent	11	4.35	
	Very large extent	5	4.35	
Availability of capital for upgrade of equipment like production process line and packing machine.	Very small extent	30	20.09	2.42
	small extent	38	33.04	
	Neutral	24	20.87	
	Large extent	15	13.04	
	Very large extent	8	6.96	
	Grand mean			2.4

Source: Own Field Survey (2021)

Results found from the above table indicate that capital factors considered had average mean value of 2.4 and above 50% have a negative response for the capital issue factors, which means factors affecting on the operational productivity is to Small extent**.** The study finding is in favor of the result found by Francis (2010) which found that the effect of availability of capital for production operations, purchase of equipment and upgrading of equipment on operational productivity was very small.

4.4.6. Ergonomics/Safety Issues Affecting Operational Productivity

Ergonomics/Safety issues are the sixth key issue that can affect operational productivity. The respondents were asked to indicate the extent to which operational productivity has been affected by ergonomics/safety factors in the APF on a five-likert scale.

Table 4.7: Ergonomics/Safety Factors Affecting Operational Productivity

Factors	Response	Frequency	Percent	
Occurrence of accidents in the production department.	Very small extent	38	33.04	2.14
	small extent	38	33.04	
	Neutral	26	22.61	
	Large extent	11	9.57	
	Very large extent	2	1.74	
Motions, reaches and travel distances of a job within a workstation.	Very small extent	36	31.3	2.27
	small extent	39	33.91	
	Neutral	20	17.39	
	Large extent	14	12.17	
	Very large extent	6	5.22	
Searching for lost or misplaced items.	Very small extent	35	30.43	2.42
	small extent	37	32.17	
	Neutral	24	20.87	
	Large extent	18	15.65	
	Very large extent	6	5.22	
The unavailability of protective devices (gloves, goggles, boot, and mask).	Very small extent	35	30.43	2.25
	small extent	38	33.04	
	Neutral	25	21.74	
	Large extent	12	10.43	
	Very large extent	5	4.35	
The unavailability and inaccessibility of medical facility treatment.	Very small extent	34	29.57	
	small extent	38	33.04	2.28
	Neutral	25	21.74	
	Large extent	13	11.3	
	Very large extent	5	4.35	
	Grand mean			2.38

Source: Own Field Survey (2021)

Findings presented in Table 4.7 above indicated that an average mean value of ergonomics/safety factor is rated to 2.38 and considered not much effect on operational productivity. The study findings disagree with results from a study by Maudgalya et al. (2008) that manufacturing concerns that emphasize on safety approach actively contribute to existing productivity and quality level.

4.5. Exploratory Factor Analysis

Prior to performing factor analysis (principal component analysis) the suitability of data for factor analysis was assessed. The Kaiser–Meyer–Olkin (KMO) value indicates the sampling adequacy of the data. The KMO value was .759 which signifies that each factor contains sufficient items for making groups in factor analysis exceeding the recommended value of .6 (Kaiser, 1974). Furthermore, the probability value of Bartlett's test of Sphericity is 0.000, which indicate that the correlation between the variables is adequate at 5 percent level of significance and is sufficient for factor analysis (See Appendix 6).

Factor analysis is a statistical technique which is used for data reduction. The reason to apply this test is to reduce a large number of items into smaller numbers. Factor analysis helps researchers to check the variables belongings in the sample data. In addition, the principal component analysis was used to confirm the construct validity of the items which is also an important feature of factor analysis.

All the factors under the study combined were far too many and factor analysis was performed on the factors affecting operational productivity, in order to reduce the factors into some meaningful number.

Operational productivity originally has 44 questionnaire items, which was reduced to 39 items by applying extraction method which is principal component analysis (see appendix 7). The scree plot in appendix 8 also shown the explained variance of the components in the line graph.

On the basis of the analysis, the researcher then grouped the 39 items into seven components which have eigenvalue greater than one. Generally, total variance explains the distributions of variance among the potential variables while the eigenvalues measure the variance explain. For all factors, the eigenvalues must be greater than 1.0. In this study, the eigenvalue for all the seven potential variables are greater than one and explaining 15.982 percent, 15.094 percent, 14.605 percent, 13.511 percent, 12.654 percent, 10.778, and 7.187 percent respectively and in aggregate explained a total of 89.812 percent with factor loading between 0.667 and 0.832.

4.6. Regression Model Assumptions Test

4.6.1. Normality

The normality is the assumption that each variable and all linear combinations of the variables are normally distributed. This test of normal distribution could be checked by graphical method of tests (histogram and dot plot). The researcher tested it using histogram and normal probability plot (NPP). In the histogram, one can decide simply by watching the distribution of the data in the histogram. Regarding the normal probability plot, the decision rule is, if the fitted line in the NPP is approximately a straight line, one can conclude that the variables of interest are normally distributed (Gujarati, 2004). Appendix 3 tells us that the normality assumption is met in this study.

4.6.2. Linearity

The assumption of linearity in multiple regressions assumes that there is a linear relationship between any predictors and the outcome variable (Field, 2009). The regression residual in Appendix 4 and 5 shows the regression residual plot and the scatter plot of residuals. Thus, providing support for the specified linear relationship.

4.6.3. Independence of Errors/Error Autocorrelation

Though, this assumption is more demanding with time series data, checking for error autocorrelation (independence of error) is appreciated for the best prediction of the model. This assumption refers to that errors in the regression are independent; this assumption is likely to be met if the Durbin–Watson statistic is close to 2 and between 0 and 4 (Field, 2009). The Durbin–Watson statistic test for this study found is 1.273 which shows the assumption of independence of errors is met (see Table 4.9).

4.6.4. Multi Collinearity Test

This assumption assumes that predictors should not be too highly correlated. This assumption can be checked with tolerance and *VIF* statistics (Field, 2009). *Variance Inflation Factors (VIFs)* above 10 or Tolerances below 0.1 are seen as a cause of concern. In this study, Variance Inflation Factors (VIFs) are below 10 and Tolerances are greater than 0.1. So this assumption is met. Table 4.8 presents the results of collinearity statistics.

Table 4.8 Collinearity Statistics between the Independent Variables Coefficients

Model	Collinearity Statistics	
	Tolerance	VIF
Human Resource Issue	.343	2.914
Capital	.964	1.038
Quality Issue	.630	1.588
Safety Issues	.384	2.602
Management Issue	.363	2.754
Technology Issues	.744	1.345

a. Dependent Variable: Operational Productivity

Source: SPSS Data (own calculation)

4.6.5 Homoscedasticity Test

Homoscedasticity assumption refers the range of variance for the dependent variable is uniform for all values of the independent variables. The assumption is checked by scatter plot diagram stated in Appendix 5. The rectangular distribution of residuals in the scatter plot of the standardized residuals shows residuals are roughly distributed with most of the scores concentrated on the center. This shows no clustering of data to suspect heteroscedasticity (higher on one side than the other). So the data is *homoscedastic* rather than *heteroscedastic*.

4.7. Regression Analysis on the Factors Affecting Operational productivity

The study has been investigating the variance predicted by selected factors on APF operational productivity. The analysis planned to examine contribution of selected study factors to the pesticides industry.

The regression analysis was performed based on data collected from selected employee of the factory. It demonstrated the relationship between operational productivity and independent variables.

Table 4.9: Analysis of variation (ANOVA)

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.024	6	2.337	31.710	.000[b]
	Residual	7.813	106	.074		
	Total	21.838	112			

a. Dependent Variable: Operational Productivity

b. Predictors: (Constant), Technology Issues, Human Resource Issue, Capital, Quality Issue, Safety Issues, Management Issue

Table 4.9 above showed that the output in the ANOVA table displayed the statistical significance of the overall model by *p- value of F-statistics = 0.000*which is below the *critical alpha value even at 1%*, which means, the independent variables jointly have *statistically significant* effect to the dependent variable operational productivity. Therefore, all the explanatory variables jointly able to explain variation in the outcome variable operational productivity.

R Square (R2)

The *R2* measures the goodness of the model to fit with the data. It reports the proportion of the total variation/dispersion in the outcome variable that are explained by the variation in the explanatory variable/s in the regression (Gujarati, 2004).

Results in table 4.10 below, indicated that the coefficient of determination (R2) equals .642. This shows that quality, management, technology, human resources, ergonomics/safety, and capital jointly explain 64.percent of the variations in operational productivity leaving 36 percent unexplained. The model is adequate in predicting the response of the dependent variable. Table 4.10 presents the R-square and Adjusted R-square results.

Table 4.10: R Square (R2)

Model summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Dublin Watson
1	.801	.642	.622	.2715	1.273

a. Predictors: (Constant), Technology Issues, Human Resource Issue, Capital, Quality Issue, Safety Issues, Management Issue

b. Dependent Variable: Operational Productivity

Regression Results

As shown in Table 4.11 below, the level of impact of each independent variable has on the dependent variable can be examined by unstandardized Beta coefficient. The regression coefficient explain the average amount of change in dependent variable that caused by a unit of change in the independent variable. The larger value of Beta coefficient that an independent variable has, brings the more support to the independent variable as the more important determinant in predicting the dependent variable.

The R-squared value only indicates the variance in overall productivity of pesticides industry as it is explained by the independent variables. However, it is observed that the extent to which each independent variables influence the dependent variable, quality, management, capital, technology, human resource was found to be the determinant of operational productivity of APF.

Thus, multiple regression analysis was conducted from the summarized data by considering the unstandardized Beta coefficients and the following regression model was fitted and presented in table 4.11.

Table 4.11: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.135	.599	.13	.140	.889	-1.103	1.271
	Quality Issue	.196	.038	.262	5.011	.000	.116	.267
	Management Issue	.564	.075	.479	7.992	.000	.448	.744
	Technology Issues	.383	.018	.218	8.552	.000	.120	.192
	Human Resource Issue	.537	.143	.248	3.940	.000	.280	.848
	Capital	.246	.053	.124	1.548	.124	-.023	.188
	Safety Issues	.487	.189	.203	1.706	.091	-.052	.698

Source: own field survey (2021)

The regression model employed in this study was the following:

OP = β0 + β1 (Q) + β2 (M) + β3 (T) + β4 (HR) + β5 (K) + β6 (E/S) + ε

After running this equation, the final regression model is as follows.

OP= .135+ .196 (Q) + .564(M) + .383 (T) + .537 (HR)

The implication of the result is discussed in the following pages.

Productivity and Quality Issues

The result of multiple regression, as presented in Table 4.11, revealed that, quality has p value of .000< 0.05, which shows that quality has a positive and significant impact on operational productivity of Adamitulu pesticides factory (APF). Therefore, the null hypothesis is rejected in the study because of that quality has a positive significant impact on operational productivity. Therefore, quality has a great contribution for the increment of operational productivity of APF, keeping the effect of other explanatory variables constant. This finding is consistence with the findings of Adam & Ebert (1998) and Gilgeous (1997).

Productivity and Management Issues

The result of multiple regression, as presented in Table 4.11, showed that, management has p-value .000< 0.01, which shows that management has a positive and significant impact on operational productivity of Adamitulu pesticides factory (APF). Therefore, the null hypothesis is rejected in the study because of that management has a positive significant impact on operational productivity. So management has a potential contribution to enhance operational productivity of APF, keeping the effect of other explanatory variables constant. This finding is compatible with the finding of Heizer & Render (2008) and Krajewski, et al (2007). In addition to this, the findings of this study is in line with the findings of Lieberman, M & B (1990), in which they found the firm–level productivity has significantly affected by the performance of the management.

Productivity and Technology Issues

The regression result of table 4.11 revealed that, technology has a p-value .000< 0.01, which shows that technology has a positive and significant impact on operational productivity of APF. Therefore, the null hypothesis is rejected in the study because of that technology has a positive significant impact on operational productivity. Therefore, technology had significant contribution to promote operational productivity of APF, keeping the effect of other explanatory variables constant. This finding is agreed with the findings of White & Brutan, (2009), Chase R.B. et al., (2007), Targen, (2002) & Ochieng, (2009). The findings by Chase and his Colleagues (2014) also mentioned that technology has played a dominant role in the productivity growth of most nations and has provided the competitive advantage to firms that have adopted it early and implemented it successfully. This shows that the findings of these reports are similar to the study of the current study.

Productivity and Human Resource Issues

The result of multiple regression, as presented in Table 4.11, revealed that, human resource has p-value .000< 0.01, which shows that human resource has a positive and significant impact on operational productivity of APF. Therefore, the null hypothesis is rejected in the study because of that human resource has a positive impact on operational productivity. Therefore, human resource has a huge contribution to raise operational productivity of APF, keeping the effect of other explanatory variables constant. This study is consistence with the findings of Francis (2010) and Wilson (2005). This factor also receives support from the motivation theory which says among other things that individuals work harder if given specific rewards for good performance (Wilson, 2005).

Productivity and Capital Issues

The multiple regression result, as presented in Table 4.11, showed that capital has p-value of 0.124>0.05, which shows that capital has no a significant impact on operational productivity of APF. Therefore, the null hypothesis is do not rejected. Therefore, capital has no significant contribution to enhance operational productivity of APF. The finding of the study is alike with the finding of (Francis, 2010), which found that the effect of availability of capital for production operations, purchase of equipment and upgrading of equipment on operational productivity was very small.

Productivity and Ergonomics/ Safety Issues

The regression result of table 4.11 revealed that ergonomics/safety has a p-value 0.09> 0.05, which shows that ergonomics/safety has no significant impact on operational productivity of APF. Therefore, the researcher failed to reject the null hypothesis. The finding of this study is compatible with the finding of (Francis, 2010). Usually the effect by the pesticides is chronic, which means the effects are known later on. This may be a reason for the safety issues have not showed a significant impact on the productivity of the operation.

Finally, this study revealed a result that indicate quality, management, technology and human resource had a positive and significant with operational productivity while capital issues and ergonomics/safety issues had not a significant relationship with operational productivity of APF.

The above findings have similarities with the findings of Francis (2010) on his study on “factor affecting operational productivity of small and medium size manufacturing industry in Kenya”. Analysis of the factors indicated that quality, human resource issues, management and technology related issues had a strong effect on operational productivity. On the other hand, capital and ergonomics/safety had a small to very small effect on operational productivity.

Similar result was found by Srivastava & Patel (1990), revealed that operational productivity of pesticides formulator in the case of India, they found that Technology and good management have an impact on the productivity of India pesticides formulator companies in their business. Besides this the sectors needs qualified human resource for the company’s successfulness and in utilizing the resources efficiently.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This part of the study has three sections. The first section presents summary of the major findings, the second section presents conclusion drawn from result and discussion. The third section presents possible recommendation forwarded based on the conclusion of the study.

5.1. Summary of Major Findings

The purpose of this study was to determine factors that affect operational productivity of Adamitulu pesticides factory (APF). The study used quality, management, technology, human resource, capital and ergonomics/safety as factors that affect operational productivity.

Based on the quantitative data analysis and discussion of results, the following are the summary of major findings of this study.

For this purpose, the researcher was able to collect 115 questionnaires and inserted into SPSS 24. To achieve the objectives of the research, the Structural Equation Model was applied with exploratory factor analysis to reduce irrelevant items. As a result, from 44 measurement items, 39 items were chosen using the principal component analysis method in SPSS 24. Before going into hypothesis testing, internal consistency measures such as Cronbach alpha reliability, convergence validity and normality & linearity assumptions, collinearly diagnostic, independence of errors, model fit and indices have adequately tested. Seemingly, all values for composite reliability and AVE calculated in this study meet the recommended threshold values. Finally, the research findings are presented as follows:

The results of factor analysis showed that the KMO value was .720, which signifies that each factor contains sufficient items for making groups in factor analysis exceeding the recommended value of .6. Furthermore, the probability value of Bartletts test of Sphericity is 0.000, which indicates that the correlation between the variables is adequate and sufficient for factor analysis. Loading factors of most of the constructs are the main determinant and have positive relationship with the underlying factors and some of the constructs have a moderate positive correlation with the factors under consideration. All the constructs are significant and have a p-value less than 0.05.

The result of descriptive statistics showed that the cumulative mean of quality revealed mean value of 4.49, which implies quality is positively contributing to APF operational productivity level. The overall mean of management showed mean value of 4.39, which implies that management is positively influencing APF operational productivity level. The total mean of technology revealed mean value of 4.34, which indicates technology is contributing for APF operational productivity to a large extent.

The cumulative mean of human resource showed mean value of 3.80, which implies that human resource is positively contributing to APF operational productivity level. The capital scored mean value is 2.4 and Ergonomics/safety scored mean value of 2.38, which implies that capital and ergonomics/safety are not positively contributing to APF operational productivity level.

Generally, results from descriptive analysis indicated that quality, human resource related issues, management and technology related issues had a strong effect on operational productivity whereas capital and ergonomics/safety had a modest effect.

The coefficient of determination R2 = 64% of the regression model indicates that the model was adequate in predicting operational productivity from the six variables, that is, quality, management, technology, capital, human resources, and ergonomics/safety. This means that these variables jointly able to explain 64 percent of the variations in operational productivity. Hence the regression model was significant. The analysis of each variable indicated that quality, management, technology, Human resource issues were statistically significant at 5% confidence level indicating that these variables could be used to predict the level of operational productivity in manufacturing concerns. However, Capital issue and ergonomics/safety were not statistically significant at 5% confidence and hence cannot be useful in the model as they are not good predictors of operational productivity levels. Accordingly, Capital issue and Ergonomics/safety have dropped from the regression model.

5.2. Conclusions

The study aimed to investigate factors, which are affecting operational productivity of Ethiopian pesticides industry using Adamitulu Pesticides Factory (APF) as a case and to prioritize those factors based on their impact.

The explanatory variables quality, management, technology and human resources issues were the main factors influencing operational productivity or showing positive significant effect while Capital and ergonomics/safety issues had not significantly affect operational productivity of Adamitulu pesticides factory considered in the study.

More specifically the independent variables were ranked as follows in order of their increasing contribution to operational productivity: Quality, Management, Technology and Human resources.

The first hypothesis was effects of quality issues on operational productivity. It has a highest effect on operational productivity than other variables did. This entails that APF factory should emphasized and subsequently improved quality related issues, then no return of product, waste is eliminated, hours are not wasted reworking products and this enhance their operational productivity.

Another hypothesis was effects of management issues on operational productivity. It has also a larger effect on operational productivity of APF. This direct effect suggested that APF management for effectively coordinate and plan production activities, used labor specifically in the production department and Co-ordination of production activities to improve productivity. Thus, more effective use of resources and coordination of the product activities, which requires managerial skills contribute extensively to APF.

The third hypothesis was effects of technology issues on operational productivity of APF. It has a positive effect on operational productivity. This result suggested that APF to use advanced the existing processing technologies level, the product design technology and up to date production technologies and facilities in order to improve their operational productivity and become competitive in the pesticides market as well.

Finally, Human resource related issues have positive effects on improving operational productivity. When workers have incentives, pay increments and improved skill operational productivity of APF will enhance tremendous level.

5.3. Recommendations

This study has demonstrated that factors affecting the operational productivity of Adamitulu pesticides factory (APF). In light of the result and conclusions made above, the following possible recommendations are suggested as being valuable to the pesticides industries and to other concerned stakeholders for improving their productivity and becoming competitive in the pesticides market.

To improve operational productivity, pesticides industries in general and AFP in particular need to enhance their human resources capacity especially for employees who work in production department through provision of skills, new skill and incentives. This should be done in line with improvement efforts in quality of their pesticides product through selection of the raw material, recipe of the product, reduction in defective and returned products, enhanced product characteristics and conformance to specifications. Factories need to upgrade the existing processing technologies level, the product design technology and other related facilities including information technology. Measures to improve planning and coordination of production activities together with supervision of staff and control of raw materials need to be put in place.

Finally, since Agriculture is a backbone of the Ethiopian economy and the pesticides are one of the key input for agricultural productivity, both pesticides industries and government need to work in close collaboration to properly utilize the potential in agriculture and to boost its contribution to the Economy such as foreign currency earning, GDP, and the overall economic development. To do that there should be an urgent and progressive effort on factors, which are dealt in this study to bring them to a level which they will have significant and positive impact on pesticides industries operational productivity as they does in the rest of the world.

5.4. Suggestions for Further Studies

While this study tried to identify only six determinant factors to examine operational productivity of Adamitulu pesticides factory(APF), the list of factors are by no means an exhaustive list and could be expanded upon for future studies. The six factors accounts for 64 percent of the contribution for operational productivity of APF. This indicates that some of important variables, which determine the operational productivity of Ethiopian pesticides industries might have been left for future investigation. Therefore, future study should include interview survey method where the researcher could have got an opportunity to uncover the feelings of the respondents in addition to scale measurement.

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Appendices

Appendix 1: Questionnaire

QUESTIONNAIRES

St. Mary'sUNIVERSITYSCHOOL OF GRADUATE STUDIES

MBA REGULAR PROGRAM

Questionnaire to be filled by Adamitulu pesticides employee

Dear Respondents:

My name is Seifedin Beredin and I am Masters of Business Administration (MBA) graduate student at St Mary University. For my final project, I am examining the Factors Affecting Operational Productivity of Pesticides manufacturing industry in Ethiopia: The case of Adamitulu pesticides factory. Because you are working in the Adamitulu pesticides factory. I am inviting you to participate in this research study completing the attached surveys. This questionnaire is designed to get idea about which factors make influence on Adamitulu's operational productivity.

The following questionnaire will require a maximum of **15 - 20** minutes to complete. There is no compensation for responding nor is there any known risk. Your response will remain confidential and will not be used for any other purposes other than the intended purpose.

I am asking you to look over the questionnaire and, if you choose to do so, complete the questionnaire based on the instructions and send it back to me through my address.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me at **+251 9 11 463517** or at **seberedin@yahoo.com**

I am grateful for your cooperation in advance!!

PART I: General Instructions

1. No need of writing your name.
2. Please fill out the answer by putting "√" mark.
3. Please return the completed questionnaire as much as possible.
4. If you need further explanation, you can contact me through the address mentioned above.

PART II: General Information

1. **What is your age?--------------Years**

2. **Please choose your gender from the given options**

A. Male ☐

B. Female ☐

3. **Please choose your level of education from the given options**

A. Grade 12 completed ☐

B. TVET levels ☐

C. Bachelor Degree ☐

D. Master Degree ☐

E. Ph.D. Degree ☐

4. **How long you worked in the organization?---------------Years**

5. **Could you please specify your managerial position in the organization?**

A. Top Manager ☐

B. Middle level manger ☐

C. Subordinate ☐

6. **Please choose your department in the organization**

A. Production and Technique Department. ☐
B. Finance Department ☐
C. Procurement and store Department ☐
D. Human Resource Management Department ☐

E. Research and Development Department ☐
F. Marketing Department ☐
G. Quality assurance Department ☐

PART III: Factors affecting productivity of the Adamitulu's operational productivity.

1. Does your company compare output level (pesticides production) with input level (raw materials used)?

1) Yes ☐ 2) No ☐

2. To what extent have the following factors affect Adamitulu's operational productivity (ratio of your company output (pesticides) to the inputs (raw materials, machine, labor) used in the production process? Put (√) to the response that indicate your level of perceptions.

1= Very Small Extent; 2= Small Extent; 3= Neutral; 4= Large Extent; 5=Very Large Extent

Perceptions of respondents towards the factor affecting Factors Affecting Operational Productivity of Adamitulu pesticides factory	Likert scale				
	1=Very small extent	**2=Small extent**	**3=Neutral**	**4=Large extent**	**5=Very large extent**
Operational productivity(Y)	1	2	3	4	5
Improved quality of product					
Reduced cost of operation/production					
Increased employees productivity.					
Increased production efficiency.					
Reduced delivery time of product for market					
Frequently produce new products					

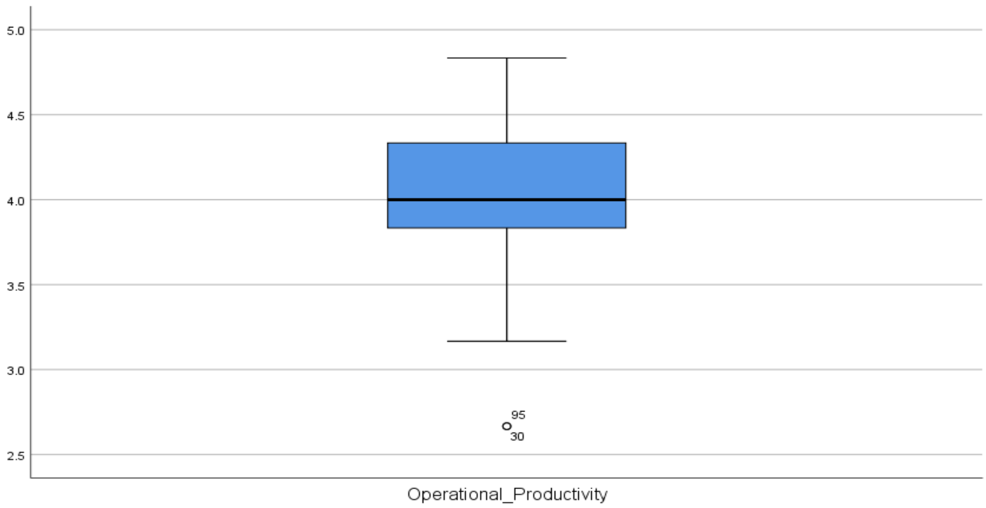
The level of productivity relative to the previous year.					
Management issues	1	2	3	4	5
Planning of production activities (work activities are planned to balance material availability, manpower, machine availability, and workload between operations).					
Co-ordination of production activities.					
Supervision of staff in the production department.					
Control of production materials.					
The availability of support from the top managementto understand problems and root causes before acting.					
Technology issues	1	2	3	4	5
The existing processing technologies level.					
The level of automation of production work.					
The product design technology.					
The availability of technology for new product and formulation					

type.					
Using of computers in production process					
The availability of an effective planned preventive maintenance system.					
Human Resource issues	1	2	3	4	5
Incentives to employees (bonuses and pay increments) for exceeding set production levels.					
The total number of hours employees worked					
Layoffs which include retrenchment, downsizing and casualization					
The skills of workers.					
Employees are encouraged to seek support from their supervisors when something goes wrong atwork.					
Employee turnover.					
Capital	1	2	3	4	5
Availability of capital for purchase of raw material and packing material,					
Availability of capital for					

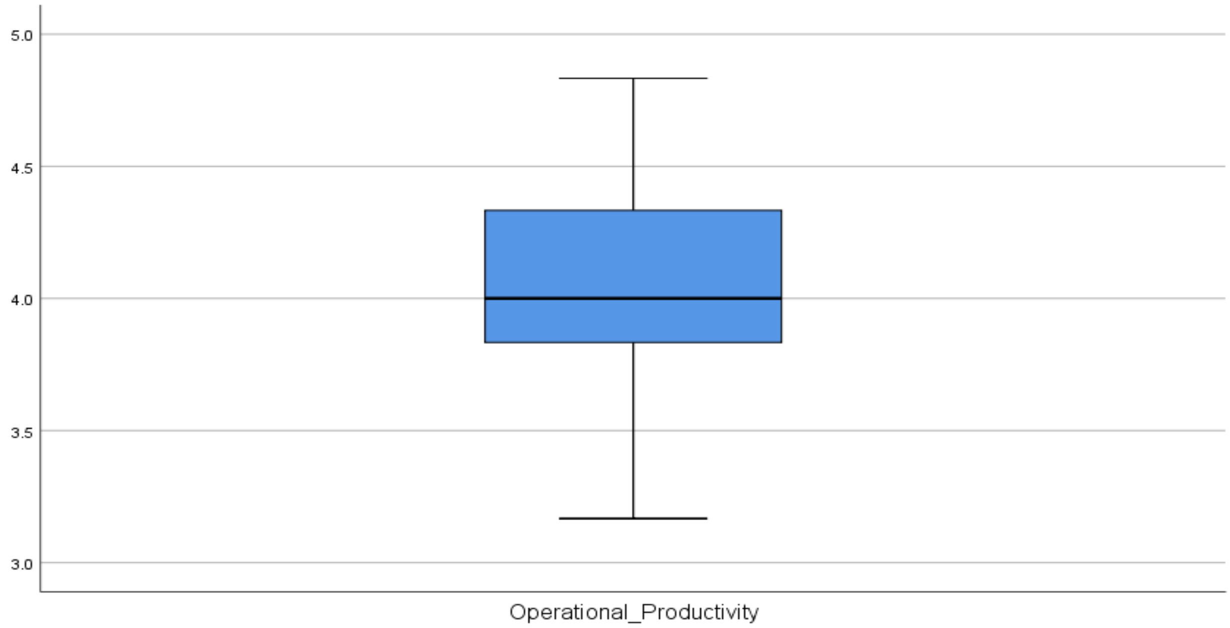
purchase of genuine spare partsand other accessories.					
Availability of capital for production operations.					
Availability of capital for upgrade of equipment like production process line and packing machine.					
Quality issues					
The level of scrap (a fragment left after production).					
Frequency of returned(rejected) products.					
Product characteristics such as functionality(feature), reliability(consistency), and aesthetics.					
Conformance(meet) to specifications of products.					
Frequency of defective products					
The availability of standard operating procedures (SOPs) (e.g. work processes) for each major operation/process					
Ergonomics/Safety issues	1	2	3	4	5
Occurrence of accidents in the					

production department.					
Motions, reaches and travel distances of a job within a workstation.					
Searching for lost or misplaced items.					
The unavailability of protective devices (gloves, goggles, boot, and mask).					
The unavailability and inaccessibility of medical facility treatment.					

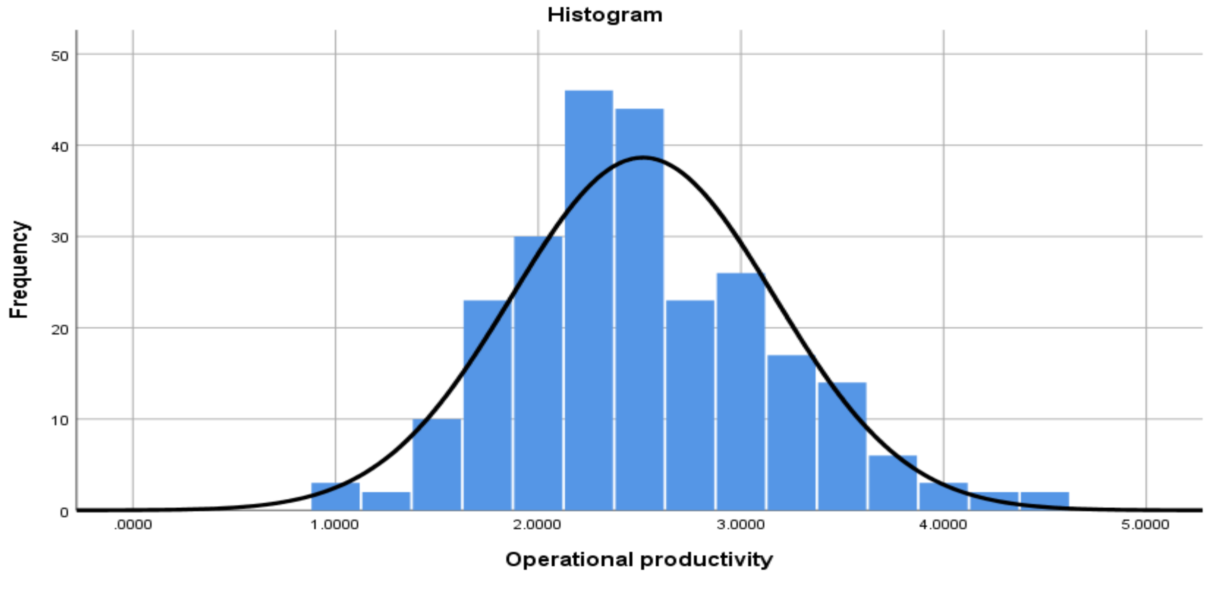
Appendix 2A: Test of Outliers



Appendix 2 B:After excluding outliers (sample no. 30 and 95)

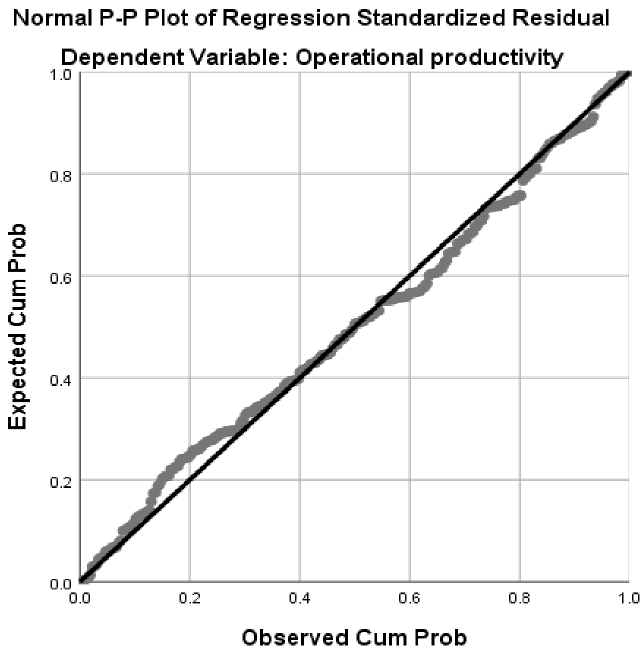


Appendix 3: Normality Assumption Test Result



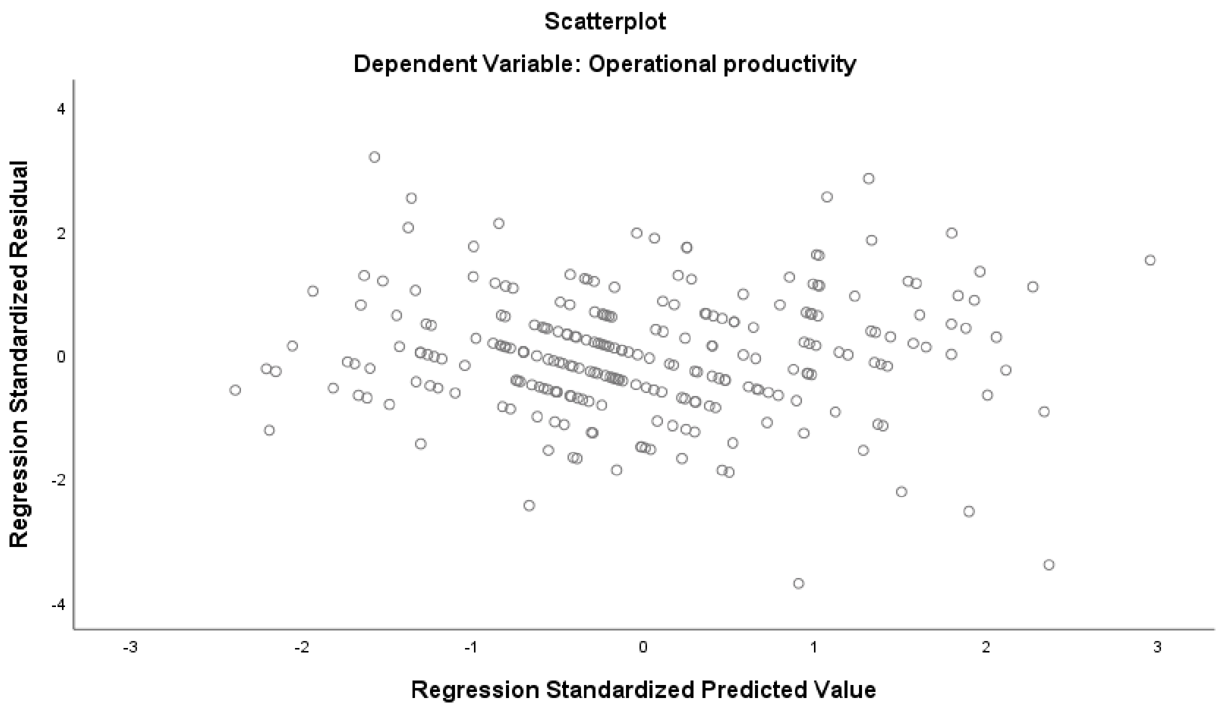
Source: SPSS Data

Appendix 4: linearity Assumption test result



Source: SPSS Data

Appendix 5: Scatter Plot of residuals



Source: SPSS

Appendix 6: KMO and Bartletts Test

Determinant = 5.562E-17

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.759
Bartlett's Test of Sphericity	Approx. Chi-Square	3636.751
	df	741
	Sig.	.000

Source: SPSS Data

Appendix 7: Factor Analysis Result

Rotated Component Matrix[a]

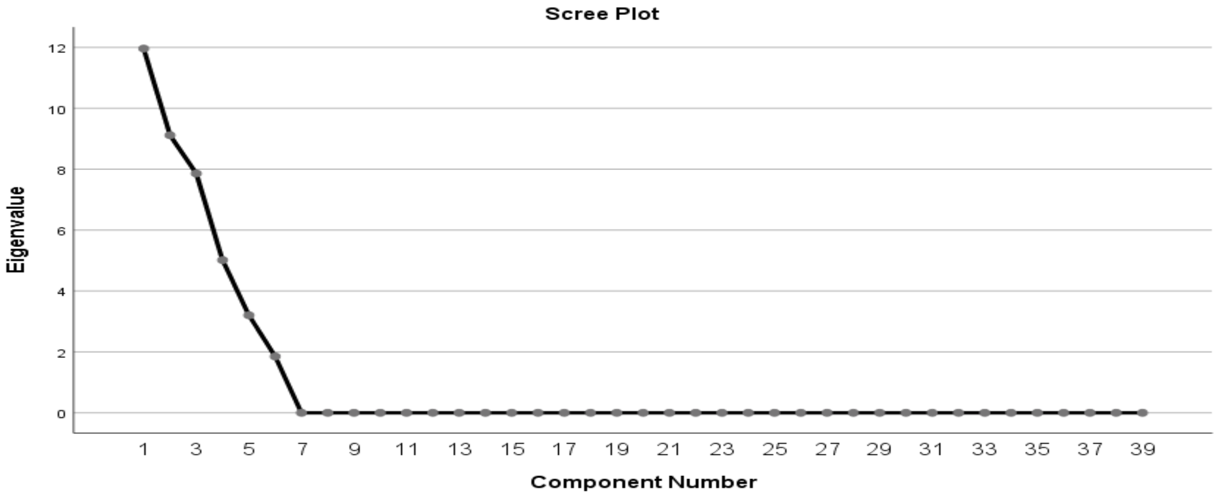
	Component						
	1	2	3	4	5	6	7
improved quality of product	.685						
reduced cost of operation production	.789						
increased employees productivity	.822						
increased production efficiency	.832						
reduced delivery time of product for market	.685						
frequently produce new products	.823						
The level of productivity relative to the previous year.	.723						
Planning of production activities		.689					
Co-ordination of production activities.		.789					
Supervision of staff in the production department.		.789	.				
Control of production materials.		.638					
The availability of support from the top management to understand problems and		.716					
The existing processing technologies level.			.789				
The level of automation of production work.		.	.747				
The product design technology.			.771				
The availability of technology for new product and formulation type.			.789				
Using of computers in production process		.	.781				
The availability of an effective planned preventive			.761		.		
Incentives to employees (bonuses and pay increments) for exceeding set production levels.				.667			
The total number of hours employees worked				.731			
Layoffs which include retrenchment, downsizing and casualization				.669			
The skills of workers.				.815			
Employees are encouraged to seek support from				.798			
Employee turnover.				.739			
Availability of capital for purchase of raw material and packing material,					.801		

Availability of capital for purchase of genuine spare parts and other accessories.					.821		
Availability of capital for production operations.					.687		
Availability of capital for upgrade of equipment like production process line and packing machine.					.783		
The level of scrap (a fragment left after production).						.731	
Frequency of returned (rejected) products.						.817	
Product characteristics such as functionality (feature), reliability (consistency), and aesthetics.						.824	
Conformance (meet) to specifications of products.						.698	
Frequency of defective products						.735	
The availability of standard operating procedures (SOPs) (e.g. work processes)						.682	
Occurrence of accidents in the production department							.712
Motions, reaches & travel distances of a job within a work stations							.738
Searching for lost or misplaced items.							.698
The unavailability of protective devices (gloves, goggles, boot, and mask).							.701
The unavailability and inaccessibility of medical facility treatment.							.713
Eigen Value	6.233	5.887	5.696	5.269	4.935	4.204	2.803
Percentage Variance	15.982	15.094	14.605	13.511	12.654	10.778	7.187
Cumulative %	15.982	31.077	45.681	59.192	71.847	82.625	89.812

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 10 iterations.
Source: SPSS (2021)

Appendix 8: Factor Analysis Scree Plot Show



Source: SPSS (2021)

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