

**A SURVEY OF THE FACTORS AFFECTING OPERATIONAL  
PRODUCTIVITY IN SMALL AND MEDIUM SIZED  
MANUFACTURING FIRMS IN KENYA**

**BY**

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**D61/70682/2007**

**A Management Research Project Submitted In Partial Fulfillment of the  
Requirements for the Master of Business Administration Degree (MBA), School Of  
Business, University Of Nairobi**

**2010**

## DECLARATION

This management research project is my original work and has not been submitted for a degree in this or any other University.

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## **DEDICATION**

To my wife, Salome Wambui Kinyua, for her whole-hearted support as I undertook the MBA degree. Many thanks to our children Esther Njeri, Shyne Wanjiru, Shalom Wambui and John Richu who endured my ‘busy-ness’ for the entire MBA period.

## **ACKNOWLEDGEMENT**

First and foremost, I wish to thank my teacher, lecturer and currently my PhD supervisor Prof. Mbeche for his inspiration and faith in my ability to successfully undertake the MBA course. “You are a great teacher, in Nairobi School then and at the University of Nairobi now, Prof”.

Special gratitude and appreciation also to all the respondents, for their time and contribution, without which this research project would not have been possible; to my supervisors, Mr. Magutu and Mr. Nyamwange for their invaluable advice, patience and encouragement, and to my wife Salome and long-time colleague Dr. Kenneth Wanjau.

To my late mum Rhoda Njeri Kiruri, I say thank you for giving your best to see me through my MSc degree and for your tireless and continual inspiration to ‘out-do’ my best.

Last but not least, to my brothers Gideon Gachara and David Mungai for their moral support and encouragement.

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## **ABSTRACT**

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.

The study utilized a survey research design. The population of this study was the small and medium sized manufacturing firms registered with the Ministry of Industrialization and whose headquarters are based in Nairobi. A semi-structured questionnaire was administered to the persons heading the production and / or operations departments in the small and medium sized manufacturing firms. Cross tabulation, correlation analysis , multiple regression analysis and factor analysis were used to determine the relative significance of the factors.

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. Correlation analysis indicated that four of the six independent variables (quality, technology, management and human resource issues) had strong correlations with operational productivity. Multiple linear regressions clearly indicated a link between safety as a business objective and increased levels of production, quality, and cost efficiency.

From the study findings, the study makes the following recommendations. First, for small and medium sized manufacturing firms to improve their operational productivity, they should enhance their human resources and consider improvement efforts in quality of their output. Firms should also adopt state-of-the-art manufacturing and information technology. To address the challenge posed by power outages, the study recommends that the government invests in alternative sources of power such as geothermal power. This will ensure a continuous supply of energy and reduce dependence on hydroelectric power which is subject to weather fluctuations.

# **CHAPTER ONE: INTRODUCTION**

## **1.1 Background of the study**

All operations have an interest in keeping their costs as low as is compatible with the levels of quality, speed, dependability and flexibility that their customers require. The measure that is frequently used to indicate how successful an operation is at doing this is productivity (Slack et al 2007).

Productivity is of great interest to the operations manager and of course, to all those who have a stake in the success of a country's organizations. Increases in productivity underpin increases in the standard of living. In fact only through increases in productivity can lead to an improvement in the standard of living (Naylor 2002).

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

The important role played by the small and medium sized manufacturing firms in Kenya's economy cannot be overemphasized. The small and medium sized manufacturing firms contribute immensely to the economic development and wealth creation through employment creation, generation of incomes, increasing productivity, facilitating technological transfers and creation of market linkages among other benefits (Government of Kenya, 2004). Currently, about 1250 small and medium sized manufacturing firms in Nairobi are registered with the Ministry of Industrialization.

### **1.1.1 Operational Productivity**

Productivity is a relative measure. To be meaningful it needs to be compared with something else. Productivity comparisons can be made in two ways. First, a firm can compare its operations with similar operations within its industry, or it can use industry

data where such dates are available. Another approach is to measure productivity over time within the same operation. Here we would compare productivity in one time period with that in the next (Chase, et al, 2007).

To increase productivity we want to make this ratio of outputs to inputs as large as practical. 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. So, the objective of the organization should be to identify 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)

Only through increases in productivity can labour, capital, and management receive additional payment. If returns to labour, capital, or management are increased without increased productivity, prices rise. On the other hand, downward pressure is placed on prices when productivity increases because more is being produced with the same resources (Heizer and Render, 2008).

High operational productivity makes it possible to manufacture products at lower costs or to higher standards of quality. Many products today from other countries are preferred by customers because of either their higher standards of quality or lower prices but are identical to those manufactured in Kenya. The same identical Kenyan products sell at a higher price or are of lower quality as a result of lower operational productivity in Kenya.

### **1.1.2 Factors affecting Operational Productivity**

Factors affecting operational productivity consist of capital, quality, technology, management, standardization, quality differences, use of the internet, computer viruses, searching for lost or misplaced items, scrap rates, new workers, safety, shortage of IT workers and other technical worker, layoffs, labor turnover, design of the workplace,

incentive plans that reward productivity increases and equipment breakdown among others (Stevenson, 2009).

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.

### **1.1.3 Small and Medium Sized Manufacturing Firms in Kenya**

Chune (1998) says that manufacturing firms are firms where operations involve transformation or converting inputs such as raw materials, labour skills, managerial skills, capital and sales revenue into products that are finally sold to the consumer. In Kenya, most manufacturing firms are located in Nairobi, Thika, Western, Nakuru, Eldoret and Athi River. The firms operate in various sectors from being food and beverage, motor vehicle assembly and accessories, leather products and footwear, textile and apparels, building and construction, plastics and rubber (Chune, 1998). Currently there are about 1250 small and medium sized manufacturing firms in Nairobi registered with the Ministry of Industrialization.

The European Commission defines a small firm as one with a staff headcount of less than 50 employees and a turnover of less than 10 million euro and a medium sized firm as one with less than 250 employees and a turn over of less than 50 million euro (European Commission, 2009). A small manufacturing firm is defined as one with between 10 and 50 employees while a medium manufacturing firm is defined as one with between 50 and 100 employees (Awuor, 2006). The Ministry of Industrialization defines a small firm as one employing between 11 and 50 employees and a medium sized firm as one employing between 51 and 100 employees (GoK, 2007). This is the definition that was adopted in this study.

Manufacturing firms in Kenya face challenges that operate in their macro-environment as well as in their micro-environment that influence their efficiency, productivity and profitability. Despite the challenges government initiatives such as Vision 2030 government has come up with specific strategies for the manufacturing sector. According to the Kenya Government vision 2030 website (2008) these are: restructuring of key local industries that use local raw materials but have no competitive edge, exploiting opportunities in adding value to import and to capture the “last step” of value addition and increasing the level of value addition in niche exports by additional processing of local agricultural products (Gatimu, 2008).

## **1.2 Statement of the Problem**

High operational productivity in manufacturing firms inevitably results in lower prices of goods and/or higher quality of goods. When quality is emphasized and subsequently improved, waste is decreased or eliminated. Hours are not wasted reworking products. Materials are not thrown away. Operations costs are reduced. At the same time, the customer receives products and services that he needs at a price he is pleased to pay and at a cost the firm can contain competitively. Moreover, the lowered prices resulting from the productivity gains stimulate an increase in the firm’s market share. It is only through an increase in productivity that the standard of living in a country increases.

Many products today from other countries are preferred by customers because of either their higher standards of quality or lower prices but are similar to those manufactured in Kenya. Similar Kenyan products sell at a higher price or are of lower quality as a result of lower operational productivity in Kenya. The Kenya 2003 Economic Survey affirms the government’s interest in the operational productivity of small and medium sized manufacturing firms. Moreover, in the Vision 2030 the government has committed to the development and creation of at least 5 small and medium enterprise industrial parks (Korir, 2009).

In the area of small and medium sized manufacturing firms a number of researches have been carried out. For example, Kilonzi (2008) researched on recruitment practices, job

satisfaction and employee retention in the Kenyan manufacturing sector. His findings indicated that job satisfaction is a key requirement for job retention but recruitment practices tend to have a weak relationship with job retention. On “Challenges facing small and medium enterprises in Kenya: the experience of Fina Bank Kenya ltd”, Wasonga (2008) found that major challenges faced by commercial banks in the process of lending to small businesses are mainly :lack of banking /credit history to allow them to access funds easily; they have no valuable collateral to act as security for their financing...

The few researches in the area of productivity include those of Wang’ombe (1999), Wanjiru (2000), Bii (2008) and Ochieng (2009). For example, Wang`ombe (1999) looked at the relationship between productivity and taxation in Kenya. Wanjiru (2000) in her study on the factors that influence the productivity of credit officers in micro-finance institutions found that experience followed by training were the most critical factors affecting productivity of credit officers in micro-finance institutions. In a study of the relationship between IT and productivity: a case study of National Oil Corporation of Kenya, Ochieng (2009) observed that IT increases the proficiency, timeliness and accuracy of factual information at the disposal of the manager, with the result that the business gains a considerable edge over its competitors and an increase in its performance and productivity.

From the studies cited above, it emerges that the factors affecting operational productivity in small and medium sized manufacturing firms have not been adequately addressed although many Kenyan firms experience low operational productivity. It is on this basis that this research project was proposed in order to establish the factors affecting operational productivity in the small and medium sized manufacturing firms in Kenya.

The study also sought to establish the challenges that these firms face as they try to achieve optimal operational productivity in their manufacturing operations.

### **1.3 Objectives of the study**

The study had two objectives:

- i. To establish the factors affecting the operational productivity of the small and medium sized manufacturing firms in Kenya.
- ii. To establish the challenges facing small and medium sized manufacturing firms in achieving optimal operational productivity.

### **1.4 Importance of the study**

To the manufacturing industry, the study will provide the firms with information on the general factors affecting their operational productivity, which they can use to enhance their competitiveness.

To the consumers of the products, the study will provide the consumer with information that they need in their choice of the small and medium sized manufacturing firms and subsequently their products.

To the researchers, the study seeks to stimulate further interest in research in other areas of the small and medium sized manufacturing firms as well as in operational productivity in other industries such as large manufacturing firms and service industries.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 The Concept of Productivity**

In industrial engineering, productivity is generally defined as the relation of output (i.e. produced goods) to input (i.e. consumed resources) in the manufacturing transformation process (Sumanth, 1994). Bernolak (1997) provides a useful verbal explanation of productivity as related to manufacturing: “Productivity means how much and how well we produce from the resources used. If we produce more or better goods from the same resources, we increase productivity. Or if we produce the same goods from lesser resources, we also increase productivity.

The term ‘resources’ refers to all human and physical entities necessary for the production of goods or provision of services. 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).

This definition 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 creation 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).

It has been argued that productivity represents one of the most important basic variables governing economic production activities (Singh, et al 2000). Grossman (1993), for example, discusses productivity improvement as one of the key competitive advantages of an enterprise in the following way: “Companies need to realize that gains in productivity are one of their major weapons to achieve cost and quality advantages over their competition.” In spite of the fact that productivity is seen as one of the most vital factors affecting a company’s competitiveness, many researchers argue that productivity is relegated to second rank and neglected or ignored by those who influenced production processes (Singh, et al 2000).



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, which relates production to all the resource used (Walters 2002). Total productivity is thus defined as the ratio of total output to total input.

By inputs is meant all the resources, employees, raw materials, energy, building equipment and so on that are required to manufacture a product or deliver a service (Williams R.S, 2002). Input indices include number of employees, hours worked, staff costs, area of sales space available, units / cost of energy used and amount /cost of raw materials used. Reducing inputs - essentially, cutting costs for the same (or greater) levels of outputs is commonly adopted as means of increasing productivity (William R.S, 2002). Output is typically taken to mean what an organization produces or the service it delivers. Examples of outputs include number of passengers carried, number of surgical operations carried out, number of units sold, shilling value of units sold and number of users of a leisure centre (Williams R.S., 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 (Walters, 2002). Partial productivity is thus defined as the ratio of total output to units of a single resource used.

Partial measures of productivity in a restaurant may be customers (meals) per labour hour; in a chicken farm it may be kilograms of meat per kilogram of feed; in a supermarket it may be sales per square foot and in a paper mill it may be tonnes of paper per cord of wood (Jacobs F R et al, 2009). Partial productivity includes: equipment productivity, labor productivity, capital productivity, energy productivity (Walters, 2002; Walters, 2006).

Where the measure of two inputs such as labour and capital is done organizations use multifactor productivity. This is the ratio of output to the sum of labour and capital, all expressed in the same monetary unit.

## **2.2 Productivity Variables**

When looking at productivity, increased productivity can be said to have happened in a firm using the following measures: cost reduction, inventory reduction, increased flexibility in operations, and reduction in delivery time of goods and services, improved quality of products and services and increase in efficiency (Ochieng, 2005).

Operational productivity variables therefore 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)

## **2.3 Measures of Productivity**

Productivity changes can either be caused by either movements 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 set 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). 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 .

## **2.4 Productivity Measurement**

Productivity measurement may be made at various levels. The levels at which productivities are to be measured for the uses of different purposes are international level, national level, industrial level, and company or organizational 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 company performance. On the other hand, productivity measurement at company or organization level will help to study the productivity of resources used. Higher company 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).

## **2.5 Factors that affect Operational Productivity**

Numerous factors affect productivity. Generally, they are quality, technology, management, labour turnover, incentive plans that reward productivity increases, standardization, use of the internet, layoffs, shortage of IT workers and technical workers, design of the workplace, computer viruses, safety and scrap rates.

And there are still other factors that affect productivity, such as equipment breakdown and shortages of parts or materials. The education level and training of workers and their health can greatly affect productivity. The opportunity to obtain lower costs due to higher productivity elsewhere is a key reason many organizations turn to outsourcing. Hence an alternative to outsourcing can be improved productivity (Stevenson, 2009).

### **2.5.1 Quality and Operational Productivity**

Over the years, the term quality has received various definitions. The quality of a product or service may be defined as the measure of the extent 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. Gower adds that quality is giving the customer what he wants today, at a price he is pleased to pay, at a cost we 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. Lean systems lead to continuous improvement in quality and improvement. 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 management’s 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 rectifying mistakes. This 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 customer’s expectations. When quality is poor, demand for products and services can diminish quickly. But what does this have to do with productivity?

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)

### **2.5.1.1 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 that can result in unplanned events, the probability of a quality failure (as well as the probability of a safety event) are both minimized. The productivity improvements are directly related to the elimination of product loss and.... (Maudgalya T, 2008).

Product standardization in particular offers benefits to customers and producers alike. Customers can count on simplicity and convenience in purchasing standardized products like household doors, screws and other fasteners, spark plugs and so on. In designing new products, standardization can bolster 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 vendors (Adam and Ebert, 1998).

### **2.5.1.2 Scrap rates and Design of the Work Place**

Scrap rates have an adverse effect on productivity, signaling inefficient use of resources. Design of the workplace can impact productivity, for example 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.

## **2.5.2 Management and Operational Productivity**

In general usage the word management identifies a special group of people whose job it is to direct the efforts and activities of other people towards common objectives. Simply stated management gets things done through other people". Management can be defined

as the process by which a cooperative group directs actions toward common goals. Thus, management involves techniques by which a distinguishable group of people (managers) coordinates activities of other people; managers seldom actually perform the activities themselves (Massie, 2004).

Management is one of the productivity variables that are critical to productivity improvement, other variables being labor and capital. Management contributes to about 52% of the annual increases in productivity. More effective use of capital in selecting the best new capital investment as well as improving the productivity of existing investments falls in the domain of operations managers. Thus, more effective use of capital which requires managerial skills contributes to productivity (Heizer and Render, 2008).

Management is responsible for ensuring that labor and capital is effectively used to improve productivity. This increase includes improvements made through the use of knowledge and the application of technology. Use of knowledge and application of technology requires ongoing education and training. These are high cost items that are the responsibility of operations manager as they build organizations workforces. Poorly educated labour is a second-class input and a country cannot be a world-class competitor with second-class inputs (Heizer and Render, 2008).

### **2.5.2.1 Role of Management in Productivity Improvement**

The way processes are managed plays a key role in productivity improvement. Managers must examine productivity improvement. Manager 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 relative 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 maintain the same level of output, while reducing the use of resources, productivity also increases (Krajewski, et al 2007).

A research carried out 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 (Lieberman, et al, 1990).

### **2.5.3 Technology and Operational Productivity**

Technology has been defined in a variety of ways. This range of definitions demonstrates that a variety of different perspectives on technology exists. 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; the technical means people use to improve their surroundings or the application of science, especially to industrial or commercial objectives - the entire body of methods and materials used to achieve such objectives (White and Brutan, 2009).

Integrating these various definitions, we can define technology as the practical implementation of learning and knowledge by individuals and organization to aid human endeavour. 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.

Technology is one of the key dimensions for managing operations and change. Technology influences productivity improvement pervasively. It is a combination of processes and technology in terms of equipment and hardware through which a product or service is produced or delivered. The systems of combined processes and technology have a great deal to do with productivity improvement and .... (Gilgeous, 1997). 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 and Brutan, 2009).

Technology has played a dominant role in the productivity growth of most nations and has provided the competitive edge 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 R.B. et al, 2007).

With more modern technologies the benefits are not entirely tangible and many benefits may be realized only on a long term basis. Thus, typical cost accounting methods and standard financial analysis may not adequately capture all the potential benefits of technologies such as CIM. Hence, we must take into account the strategic benefits in evaluating such investments. Further, because capital costs for many modern technologies are substantial, the various risks associated with such investments have to be carefully assessed (Chase R.B. et al, 2007).

Implementing flexible manufacturing systems or complex decision support systems requires a significant commitment for most firms. Such investments may even be beyond the reach of SMEs. 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. (Chase R.B et al 2007).

### **2.5.3.1 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 culminates with design that meets several design objectives (Adam and Ebert, 1998).

Process technology refers to the equipment, people and systems used to produce a firm's products and services. Key process technology decisions relate to organizing the process flows, choosing the appropriate product-process mix, adapting the process to meet



strategic requirements, and evaluating automation and high technology processes (Adam and Ebert, 1998).

### **2.5.3.2 Technology and Mechanization**

The conversion process is the central element of the production and operations function. The work of operations management revolves around conversion, where resource inputs are converted or transformed into useful products and services. This conversion process is the same in most manufacturing organizations, but it is distinctly different for service organizations. The basic technologies of operations differ among industries as well as within various organizations in any one industry. The blending of labor, land, capital and management – and the scientific expertise needed for this task- are at the very heart of technology in operations (Adam and Ebert, 1998).

Organizations today face decisions about which technology to use and the degree of mechanization. Mechanization is the process of bringing about the use of equipment and machinery in production and operations. Many of the challenges for improved productivity and quality are met as managers adopt more sophisticated technologies and increased mechanization. Competitors who effectively substitute capital and equipment for labor to lower operating cost may increase market share very quickly. On the other hand, mechanization, when it is unnecessary or inappropriate, may be quite costly. A firm may be saddled with high fixed cost relative to other companies in the industry. Responding correctly to the question of what degree of technological change, mechanization, and automation is strategically best for any one organization is often critical to the survival of the business (Adam and Ebert, 1998).

### **2.5.3.3 Productivity and IT**

Information technology (IT) is defined as the study, design, development, implementation, support, or management of computer-based information systems, particularly software applications and computer hardware. ICT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit and securely retrieve information (ITAA-2002).

IT 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 IT and enhance service delivery or production of goods is enhanced increasing the overall efficiency of the organization (Targen, 2002).

IT is regarded as a fundamental factor of production (Hannon and Freeman, 1994). Its role as an important organization resource just like land, capital and labor is increasingly being realized. 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 (Peterat, 1993). The proficiency, timeliness and accuracy of factual information at the disposal of the manager, can give a business a considerable edge over its competitors, and increase the organization's performance and productivity (Ochieng, 2009).

In an article in the Daily Nation of 23<sup>rd</sup> September 2008 it was observed that, technologically, the SMEs have gained from recent developments in the ICT sector. The firms have been able to cut down on production costs by moving away from labour-intensive production processes toward machine oriented manufacturing processes thus reducing on labour costs as well as on wastage of time and raw materials (Daily Nation; 23<sup>rd</sup> September 2008) (Gatimu, 2008). Alternatively, management of technology may be defined as the linking of different disciplines to plan, develop, implement, monitor and control technological capabilities to shape and accomplish the strategy objectives of an organization.

#### **2.5.3.4 Use of the Internet**

This 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 foreseeable 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... consumer behaviour and the way companies market to both consumers and businesses have changed dramatically (Johnson et al, 2009).

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

### **2.5.4 Capital and Operational Productivity**

The measurement of capital is perhaps the most problematic of inputs to measure (Morrison, 1998). 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). The acquisition 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).

### **2.5.5 Human Resource and Operational Productivity**

#### **2.5.5.1 Labour Turnover**

Labour is the workforce of an economy or organization. Labour – turnover or employee turnover is then the measurable incidence of people joining and leaving an organization. Among other measures of labour turnover is the index given by the ratio of employees leaving the organization in a particular year to the average number of staff in post that year multiplied by one hundred (Williams, 2002) Thus, a company which requires 50 machinists throughout the year and has 5 of these leave in one year will have the turnover rate of  $(5/50) \times 100 = 10$  percent.

The turnover rate enables employers to forecast demand for employees in specific categories in subsequent years. Some causes of high labour turnover include poor handling of new recruits (which can be remedied by designing and implementing an induction process); job dissatisfaction (which can be addressed by improving job design and hence development of accurate job description and job specification) and employing

recruits who are not equipped for work demands (this can be remedied by improving recruitment and selection practices as well as by improving training). High labour turnover has a negative impact on productivity in the long – run as the employees suffer from low – morale and job insecurity (survivor syndrome) (Williams R.S, 2002). Further, replacements need time to get up to speed (Stevenson, 2008).

### **2.5.5.2 Incentive Plans that Reward Productivity Increases**

These can boost productivity. This is supported by Vroom’s expectancy theory that maintains that people will make an effort to achieve a standard of performance if they perceive 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 J.P, 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 E, 1994).

### **2.5.5.3 Layoffs, New Workers and Shortage of IT workers and other**

#### **Technical workers**

The effect of layoffs can be positive and negative. Initially productivity may increase after a layoff, because the workload remains the same but few workers do the work- although they have to work harder and longer to do it. However as time goes by, the remaining workers may experience an increased risk of burnout, and they may fear additional job cuts. The most capable workers may decide to leave.

New workers tend to have lower productivity than seasoned workers. Thus growing companies may experience a productivity lag. Shortage of IT workers and other technical workers hampers the ability of companies to update computing resources, generate and sustain growth, and take advantage of new opportunities.

### **2.5.6 Ergonomics/Safety and Operational Productivity**

Motions, reaches and travel distances of a job within a workstation influences operational productivity. 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 toll on productivity. Poor safety conditions have been shown to greatly affect (detrimentally) 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).

### **2.6 Challenges Facing Small and Medium Sized Manufacturing Firms in Achieving Optimal Productivity**

Manufacturing firms in Kenya face challenges that operate in their macro-environment as well as in their micro-environment that influence their efficiency, productivity and profitability. Despite the challenges the government has come up with specific strategies for the manufacturing sector such as Vision 2030. According to the Kenya Government Vision 2030 website (2008) these are: restructuring of key local industries that use local raw materials but have no competitive edge, exploiting opportunities in adding value to import and to capture the “last step” of value addition and increasing the level of value addition in niche exports by additional processing of local agricultural products (Gatimu, 2008). Some of the challenges in the macro-environment are political interference, inadequate regulatory framework which is not fully supportive, frequent power outages, unreliable supply of raw materials especially for the agro based manufacturing firms – this due to reliance on rain-fed agriculture, and an unstable local currency. Other challenges include high costs of fuel and electricity, industrial disputes with regard to wages and salaries, employee liability and political instability.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Research Design**

The study utilized a survey research design in its plan of procedures for data collection and analysis to elicit information on the factors affecting operational productivity in small and medium sized manufacturing firms in Kenya.

### **3.2 The Population of the Study**

The population of this study was the small and medium sized manufacturing firms registered with the Ministry of Industrialization and whose headquarters are based Nairobi.

### **3.3 Data collection**

A semi-structured questionnaire was administered to the persons heading the production and / or operations departments in the small and medium manufacturing firms. The respondents worked with the researcher which ensured a higher response rate.

### **3.4 Data analysis**

Correlation analysis, multiple regression analysis and factor analysis were used to determine the relative importance of the factors affecting the operational productivity in the small and medium sized manufacturing firms. The SPSS computer software package was used to aid the researcher in the analysis of the data.

The independent variables included quality, management, technology, capital, human resource, and ergonomics/ safety. Thus:

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

Where OP = Operational Productivity,

Q = Quality,

M = Management

T = Technology

K = Capital

HR = Human Resource

E/S = Ergonomics/Safety

We assumed that the probability of factors affecting operational productivity in small and medium sized manufacturing firms in Kenya is determined by underlying predictor variables that captures the true listed factors above on different levels. In the case of a multiple effect status (i.e. factors affecting operational productivity), let the underlying response variable  $Y^*$  be defined by the regression relationship:

$$y_i^* = \sum x_i \beta + u_i \quad (1)$$

where  $\beta = [\beta_1, \beta_2, \dots, \beta_k]$  and  $x_i = [x_{i1} \ x_{i2} \ x_{i3} \dots \ x_{ik}]$

In equation [1],  $y^*$  is not observable, as it is a latent variable. What is observable is an event represented by a dummy variable  $y$  defined by:

$y = 1$  if  $y^* > 0$ , and

$y = 0$  otherwise (2)

We then get an outcome of 1 if  $y^* \geq 0$ , outcome 0 if  $y^* < 0$ . In this case, the probabilistic element is the error term  $u$ .

From equations [1] and [2] we can derive the following expression:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \epsilon \quad (3)$$

where;

$Y$  = Factors affecting operational productivity measured by (quality, management, technology, capital, and human resources)

$\alpha$  = constant

$\beta_4$  = coefficient of human resource

$\beta_1$  = coefficient of quality

$X_4$  = level of human resource

$X_1$  = quality

$\beta_5$  = coefficient of capital

$\beta_2$  = coefficient of management

$X_5$  = capital

$X_2$  = management

$\beta_6$  = coefficient of ergonomics/safety

$\beta_3$  = coefficient of technology

$X_6$  = ergonomics/safety

$X_3$  = technology

$\epsilon$  = Error term

# **CHAPTER FOUR: DATA ANALYSIS, FINDINGS AND DISCUSSIONS**

## **4.1 Introduction**

The study had twin objectives of establishing the factors affecting the operational productivity of the small and medium sized manufacturing firms in Kenya and establishing the challenges facing small and medium sized manufacturing firms in achieving optimal operational productivity. In seeking to achieve these objectives, the study ranked the different factors that were related to the variables under study. A total of 130 questionnaires were administered to the operations managers or their equivalents of each small and medium sized manufacturing firm in the population. Of these, 92 questionnaires were successfully filled. The response rate was therefore 78.18%, which compares favorably with Punch's (2003) stipulation of an acceptable response rate. Punch (2003) indicated that high response rates help to ensure that survey results are representative of the target population. Punch (2003) indicated that acceptable response rates vary by how the survey is administered. For e-mail and face to face administered questionnaires, a response rate of above 60% is considered adequate.

Once the data was collected it was checked for completeness and consistency. The data was analyzed by use of descriptive statistics and inferential statistics. This included the list of tables and percentages to represent the response rate and information on the variables that the study considered. Frequency distribution was also used to summarize the results for presentation. Cross tabulation was used to determine the relationship between various variables and the operational productivity. The findings of the study are presented in three parts. The first part presents the cross tabulation based on different variables under consideration. The analysis was done as per questionnaires that were used to collect data. Data was categorized in terms of factors affecting operational productivity. The second part presents findings using correlation analysis while the third part presents data based on regression analysis.



## 4.2 Factors Affecting Operational Productivity

The factors were grouped into six categories according to how they relate to the five constructs under study i.e. quality, management, technology, human resource issues, capital and ergonomics/safety. This part presents the cross tabulated data for each construct based on a rating defined by the following scale: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5

### 4.2.1 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 their firms on a five-likert scale of: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5. The results are as in table 4.1

**Table 4.1: Quality Issues Affecting Operational Productivity**

Quality Issues	Descriptive Statistics	
	Mean	Std. Deviation
The level of scrap	4.9247	.26525
Frequency of returned products	4.8172	.53051
Product characteristics such as functionality, reliability, and aesthetics	4.7742	.51349
Conformance to specifications of products	4.7692	.59772
Frequency of defective products	4.6237	.90786
Customization of your firm's products	4.6237	.90786
Standardization of your firm's products	3.2500	.79317
Valid N (listwise) = 91		

**Sources: Research data, (2010)**

From the data analysis of quality issues affecting operational productivity in table 4.1, there are six factors that affect productivity to a very large extent (Mean  $\geq 4.5$ , with significant standard deviation) are: the level of scrap; frequency of returned products;

product characteristics such as functionality, reliability, and aesthetics; conformance to specifications of products; frequency of defective products; and customization of the firm's products. However, standardization of products was not perceived to affect operational productivity much.

#### 4.2.2 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 their firms on a five-likert scale of: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5. The results are as in table 4.2.

**Table 4.2: Management Issues Affecting Operational Productivity**

Management Issues	Descriptive Statistics	
	Mean	Std. Deviation
Planning of production activities	4.8602	.34864
Co-ordination of production activities	4.7312	.57369
Supervision of staff in the production department	4.5747	.67569
Control of production materials	3.3763	1.03119
Availability of technical workers such as machine operators	3.3684	.94591
Selection of new capital investment	3.0538	1.22799
Valid N (listwise) = 87		

**Source: Research data (2010)**

Results in table 4.2 indicate that planning of production activities, coordination of planning activities and supervision of staff in the production department, affected operational productivity to a very great extent (Mean  $\geq 4.5$ , with significant standard deviation). Control of production affected operational productivity to a great extent and selection of new capital investments did not have a significant effect (Mean  $\geq 3.0$ ) on operational productivity.

### 4.2.3 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 their firms on a five-likert scale of: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5. The results are as in table 4.3.

**Table 4.3 Technology Issues Affecting Operational Productivity**

Technology Issues	Descriptive Statistics	
	Mean	Std. Deviation
The level of automation of your manufacturing work.	4.9355	.24700
Availability of IT workers	4.8696	.33863
The presence of the firm's website	4.8696	.33863
The firm's processing technologies	4.8172	.53051
The firm's product design technology	4.7204	.57796
Use of computers in manufacturing work.	3.0215	.90864
Production equipment breakdown	2.9677	.66678
The incidence of computer viruses	2.8495	1.42147
Machine or equipment set-up time	1.1935	.39722
The advertising of your products in the Social Networking Sites (SNS)	1.0543	.22794
Valid N (listwise) = 92		

**Source: Research data (2010)**

Findings from table 4.3 indicate that the level of automation of the manufacturing work; the availability of IT workers; the presence of the firm's website; the firm's processing technologies and the firm's product design technology have affected operational productivity to a very great extent (Mean  $\geq 4.5$ , with significant standard deviation). The use of computers in manufacturing work; production equipment breakdown; and incidence of computer viruses have no effect on productivity (Mean  $\geq 2.5$ , with significant standard deviation). The other factors with little or very small effect (Mean  $\geq 1.0$ ) on operational productivity include machine or equipment set-up time; and the advertising of your products in the Social Networking Sites (SNS).

The study findings concurs 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.

#### 4.2.4 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 their firms on a five-likert scale of: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5. The results are as in table 4.4.

**Table 4.4: Human Resource Issues Affecting Operational Productivity**

Human Resource	Descriptive Statistics	
	Mean	Std. Deviation
Incentives to employees (such as bonuses and pay increments) for exceeding set production levels	4.8696	.33863
The level of education of workers	3.6437	.74673
The total number of hours worked by employees	3.5263	.78337
Layoffs which include retrenchment, downsizing and casualisation	3.3587	.81983
The skills of workers	3.3261	1.10054
New workers	2.7000	.66112
Employee turnover	2.6413	1.21873
Valid N (listwise) = 87		

**Source: Research data (2010)**

Results presented in table 4.4 indicate that Incentives to employees such as bonuses and pay increments for exceeding set production levels were the only human resource factor that affected operational productivity to a very great extent (Mean  $\geq 4.5$ , with significant standard deviation). The level of education of workers and the total number of hours

worked by employees affected operational productivity to a great extent (Mean  $\geq 3.5$ , with significant standard deviation). Other factors such as having new workers and availability of technical workers had little effect on operational productivity.

#### 4.2.5 Capital Issues Affecting Operational Productivity

Capital issues are the fifty key 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 their firms on a five-likert scale of: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5. The results are as in table 4.5.

**Table 4.5: Capital Issues Affecting Operational Productivity**

Capital Issues	Descriptive Statistics	
	Mean	Std. Deviation
Availability of capital for purchase of production equipments such as machines.	2.4239	.81515
Availability of capital for purchase of spare parts	2.2609	.92427
Availability of capital for manufacturing operations	1.2391	.56197
Availability of capital for upgrade of equipment.	1.0543	.22794
Valid N (listwise) = 92		

**Source: Research data (2010)**

Results indicate that the capital factors assessed had a small effect on operational productivity. The effect of availability of capital for operations and upgrade of equipment on operational productivity was very small (Mean  $\geq 2.4$ , with significant standard deviation) while purchase of equipment had a small effect on operational productivity and purchase of spare parts also had a small effect on operational productivity. On overall, capital factors considered had a small effect on operational productivity.

## 4.2.6 Ergonomics/Safety Factors Affecting Operational Productivity

Capital 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 their firms on a five-likert scale of: Very small extent = 1; Small extent = 2; Neutral = 3; Large extent = 4; and Very Large Extent = 5. The results are as in table 4.6.

**Table 4.6: Ergonomics/Safety Factors Affecting Operational Productivity**

Ergonomics/Safety Factors	Descriptive Statistics	
	Mean	Std. Deviation
Occurrence of accidents in the production department	3.9355	1.19607
Motions, reaches and travel distances of a job within a workstation	1.8710	.47149
Searching for lost or misplaced items	1.1183	.48565
Delay in delivery of spare parts of production equipments	1.1183	.48565
Valid N (listwise) = 93		

**Source: Research data (2010)**

Findings presented in table 4.6 indicate that occurrence of accidents affected operational productivity to a large extent (Mean  $\geq 3.5$ , with significant standard deviation while motion, reaches and travel distance had a small effect on productivity Mean  $\geq 1.5$ , with significant standard deviation). Searching for lost or misplaced items affected operational productivity to a very small extent (Mean  $\geq 1.0$ , with significant standard deviation).

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. This study clearly indicated a link between safety as a business objective and increased levels of production, quality, and cost efficiency.

### 4.3 Correlation Analysis on the Factors Affecting Operational Productivity

An analysis was done on how the variables under study were related to operational productivity and to each other. Findings are presented in table 4.7 below. Factors in the table are represented by the following;

Operational Productivity	– OP	Quality	- Q
Management	- M	Technology	- T
Human resource	- HR	Capital	- K
Ergonomics/Safety	- E/S		

**Table 4.7: Correlation Matrix of Variables Affecting Operational Productivity**

	<b>OP</b>	<b>Q</b>	<b>M</b>	<b>T</b>	<b>HR</b>	<b>E/S</b>	<b>K</b>
<b>OP</b>	1.000						
<b>Q</b>	.657	1.000					
<b>M</b>	.505	.385	1.000				
<b>T</b>	.583	.430	.638	1.000			
<b>HR</b>	.304	.250	.623	.494	1.000		
<b>E/S</b>	-.142	-.237	.010	-.114	-.063	1.000	
<b>K</b>	.026	-.014	.359	.446	.623	.020	1.000

**Source: Research Data (2010)**

The correlation matrix indicates that quality was strongly correlated with operational productivity (.657) and technology (.43) and slightly correlated with Human resource management (.25) although the correlation was weak. Quality seemed to be negatively correlated with ergonomics/safety (-.237) and capital (-.014) although the relationship was weak. Other strong correlations were observed between management and operational productivity (.505), technology and operational productivity (.583) and between human resource issues and operational productivity (.304). Other strong correlations were between HR and technology (.494) and HR and management (.623). Strong correlations were observed among quality, management, technology and HR while weak correlations were observed among capital and ergonomics/safety with the other variables.

#### 4.4 Regression Analysis on the Factors Affecting Operational Productivity

The coefficient of determination ( $R^2$ ) equals 0.6706. This shows that quality, management, technology, human resources, ergonomics/safety, and capital explain 67.06 percent of the variations in operational productivity leaving only 32.94 percent unexplained. The P- value of 0.000 implies that operational productivity is significant at the 5 percent level of significance

**Table 4.8: Regression Model Summary**

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
.8189	.6706	.6545	.90331	.761	10.759	6	85	.000

Predictors: (Constant), quality, management, technology, human resources, capital and ergonomics/ safety

**Source: Research data (2010)**

Results in table 4.8 indicate that about 67.06 of the variation in operational productivity can be explained by the six independent variables. This indicates that the model is adequate in predicting the response of the dependent variable.

**Table 4.9: ANOVA**

	Sum of Squares	df	Mean Square	F	Sig.
Regression	61.453	6	10.2422	30.5555	.000(a)
Residual	30.191	85	.3352		
Total	91.644	91			

Predictor Variables: (Constant), quality, management, technology, human resources, capital and ergonomics/ safety. Response Variable: operational productivity

**Source: Research data (2010)**

The f value of 30.5555 indicates that the overall regression model is significant hence it has some explanatory value (P- value  $p=0.00 < 0.05$ ). This indicates that the predictor variables have a significant effect on the output variable. This indicates that there is a



significant relationship between the predictor variables (quality, management, technology, human resources, ergonomics/ safety, and capital) and response variable (operational productivity).

Multiple regression analysis was conducted from the summarized data and the following regression model was fitted.

$$Y = -0.534 + 0.762X_1 + 0.620X_2 + 0.562X_3 + 0.315X_4 + 0.232X_5 + 0.004X_6$$

**Table 4.10: Régression Coefficients**

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
(Constant)		-.534	0.607		-.8803	.385
Quality,	X <sub>1</sub>	.762	0.114	.511	6.684	.000
Management	X <sub>2</sub>	.620	0.200	.472	3.099	.014
Technology	X <sub>3</sub>	.562	0.161	.494	3.491	.001
Capital	X <sub>4</sub>	.315	0.124	.216	2.532	.168
Human Resource	X <sub>5</sub>	.232	0.113	-.183	2.053	.004
Ergonomics/Safety	X <sub>6</sub>	.004	0.015	.012	.2667	.301

Dependent Variable: operational productivity

**Source: Research data (2010)**

From Table 4.10 above, the constant = -0.534, shows that if quality, management, technology, capital, human resources and ergonomics/safety were all rated as zero, operational productivity rating would be -0.534. X<sub>1</sub>= 0.762, shows that one unit change in quality results in operational productivity increase by 0.762 units. X<sub>2</sub>= 0.620, shows that one unit change in management results in 0.620 units decrease in operational productivity. X<sub>3</sub>= 0.562, shows that one unit change in technology results in 0.562 units increase in operational productivity. X<sub>4</sub>= 0.315, shows that one unit change in capital results in 0.315 units increase in operational productivity. X<sub>5</sub>= 0.232, shows that one unit change in human resource results in 0.232 units increase in operational productivity. X<sub>6</sub>= 0.004, shows that one unit change in ergonomics results in 0.004 units increase in operational productivity.

On significance, capital and ergonomics/safety are not significant at 5% significance level and therefore can be removed from the model. The resultant model to predict operational productivity would include quality, technology, management and human resources. The model hence indicates that quality, technology, management and human resources are strong determinants of operational productivity in that order.

#### **4.5 Factor Analysis on the Factors Affecting Operational Productivity**

All the factors under the subheadings of 4.2 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.

The results of the factor analysis using principal component analysis as an extraction method led to five (5) components extraction in table 4.11. From the output in table 4.11, where total variance is explained, only five components/factors were extracted and this explains 89.320% (on the extraction sums of squared loadings) of the factors affecting operational productivity.

**Table 4.11: Total Variance Explained on the Factors Affecting Operational Productivity**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	22.064	58.063	58.063	22.064	58.063	58.063
2	5.509	14.496	72.559	5.509	14.496	72.559
3	2.689	7.077	79.636	2.689	7.077	79.636
4	2.200	5.790	85.426	2.200	5.790	85.426
5	1.480	3.894	89.320	1.480	3.894	89.320
6	.980	2.578	91.898			
7	.569	1.497	93.394			
8	.497	1.308	94.702			
9	.339	.892	95.595			
10	.255	.671	96.266			
11	.212	.559	96.825			
12	.187	.493	97.318			

13	.152	.400	97.718			
14	.126	.331	98.048			
15	.100	.262	98.310			
16	.095	.251	98.562			
17	.085	.223	98.785			
18	.067	.177	98.962			
19	.063	.165	99.127			
20	.048	.126	99.253			
21	.046	.120	99.373			
22	.043	.113	99.486			
23	.035	.092	99.578			
24	.029	.077	99.655			
25	.028	.074	99.728			
26	.024	.064	99.792			
27	.021	.055	99.847			
28	.019	.050	99.897			
29	.015	.041	99.938			
30	.012	.032	99.970			
31	.007	.020	99.990			
32	.004	.010	100.000			
33	1.081E-16	2.844E-16	100.000			
34	1.307E-17	3.440E-17	100.000			
35	4.627E-19	1.218E-18	100.000			
36	-1.247E-18	-3.281E-18	100.000			
37	-1.478E-16	-3.889E-16	100.000			
38	-2.372E-16	-6.243E-16	100.000			

Extraction Method: Principal Component Analysis.

**Table 4.12: Component Matrix(a) on the Factors Affecting Operational Productivity**

	Component				
	1	2	3	4	5
The total number of hours worked by employees	<b>.941</b>	-.023	-.109	.033	-.153
Customization of your firm's products	<b>.929</b>	-.246	.088	-.027	.028
Frequency of defective products	<b>.929</b>	-.246	.088	-.027	.028
Layoffs which include retrenchment, downsizing and casualisation	<b>.917</b>	.052	-.041	-.034	-.172

Use of computers in your manufacturing work.	<b>.907</b>	.225	-.091	-.052	-.067
New workers	<b>.894</b>	.124	-.095	.219	-.159
The level of education of workers	<b>.891</b>	-.138	-.082	.052	.184
Availability of technical workers such as machine operators	<b>.889</b>	.180	.099	.017	-.108
Product characteristics such as functionality, reliability, and aesthetics	<b>.888</b>	-.146	-.127	.093	.264
Control of production materials	<b>.884</b>	.065	-.256	.105	-.163
Co-ordination of production activities	<b>.877</b>	-.089	-.192	.120	.214
Planning of production activities	<b>.876</b>	-.222	.048	-.004	.208
Incentives to employees (such as bonuses and pay increments) for exceeding set production levels	<b>.874</b>	-.251	.101	-.030	.176
Availability of IT workers	<b>.874</b>	-.251	.101	-.030	.176
The presence of the firm's website	<b>.874</b>	-.251	.101	-.030	.176
The firm's product design technology	<b>.874</b>	-.067	-.213	.127	.192
Conformance to specifications of products	<b>.867</b>	-.219	-.018	.048	.259
Supervision of staff in the production department	<b>.864</b>	.045	-.226	.099	-.077
The firm's processing technologies	<b>.861</b>	-.275	.057	.019	.327
Frequency of returned products	<b>.861</b>	-.275	.057	.019	.327
Selection of new capital investment	<b>.848</b>	.234	-.376	.128	-.137
Standardization of your firm's products	<b>.819</b>	.301	-.302	.062	-.099
The level of scrap	<b>.798</b>	-.339	.309	-.136	-.186
Employee turnover	<b>.775</b>	.443	-.340	.049	-.200
The level of automation of your manufacturing work.	<b>.772</b>	-.349	.338	-.149	-.258

The incidence of computer viruses	<b>.769</b>	.496	-.277	.078	-.189
The skills of workers	<b>.723</b>	.469	-.287	.114	-.222
Production equipment breakdown	<b>.551</b>	-.463	.528	-.228	-.055
Availability of capital for purchase of production equipments such as machines.	.406	<b>.796</b>	.216	-.227	.066
Machine or equipment set-up time	.355	<b>.792</b>	.296	-.252	.141
Availability of capital for manufacturing operations	.335	<b>.791</b>	.419	.017	.116
Availability of capital for purchase of spare parts	.207	<b>.681</b>	.387	-.269	.237
Availability of capital for upgrade of equipment.	.119	.374	<b>.519</b>	.721	-.014
The advertising of your products in the Social Networking Sites (SNS)	.119	.374	<b>.519</b>	.721	-.014
Occurrence of accidents in the production department	-.227	-.327	.233	<b>.734</b>	-.070
Motions, reaches and travel distances of a job within a workstation	-.400	-.771	-.174	<b>.315</b>	-.080
Delay in delivery of spare parts of production equipments	-.685	.316	-.382	.195	<b>.439</b>
Searching for lost or misplaced items	-.685	.316	-.382	.195	<b>.439</b>

Extraction Method: Principal Component Analysis.  
5 components extracted.

From the results in table 4.12 of the factor analysis using principal component analysis as an extraction method, the above five (5) components/factors can be explained as follows:

Component/Factor one: Technological and Human Capacity Factors. This can be explained by the total number of hours worked by employees; customization of your firm's products; frequency of defective products; layoffs which include retrenchment, downsizing and casualisation; use of computers in your manufacturing work; new workers; the level of education of workers; availability of technical workers such as machine operators; product characteristics such as functionality, reliability, and

aesthetics; control of production materials; co-ordination of production activities; planning of production activities; incentives to employees (such as bonuses and pay increments) for exceeding set production levels; availability of IT workers; the presence of the firm's website; the firm's product design technology; conformance to specifications of products; supervision of staff in the production department; the firm's processing technologies; frequency of returned products; selection of new capital investment; standardization of your firm's products; the level of scrap; employee turnover; the level of automation of your manufacturing work; the incidence of computer viruses; the skills of workers; and production equipment breakdown.

Component/Factor Two: Capital investment on machinery. Proper investment on machinery is the second factor affecting operational productivity. This can be explained by: the availability of capital for purchase of production equipments such as machines; machine or equipment set-up time; availability of capital for manufacturing operations; and availability of capital for purchase of spare parts

Component/Factor Three: Networking and Upgrading of systems. Networking and Upgrading of systems is the third factor affecting operational productivity. This can be explained by: availability of capital for upgrade of equipment; and the advertising of your products in the Social Networking Sites (SNS).

Component/Factor Fourth: Accidents and workstations. This is the fourth factor affecting operational productivity. This can be explained by: occurrence of accidents in the production department; and motions, reaches and travel distances of a job within a workstation.

Component/Factor Fifth: Spare parts and items arrangement. Proper Spare parts and items arrangement is the Fifth factor affecting operational productivity. This can be explained by: delay in delivery of spare parts of production equipments; and searching for lost or misplaced items.

## 4.6 Hypothesis Testing/ Individual Statistical Significance

The following hypotheses were tested as shown in Table 4.4.

Hypothesis statement 1: Quality influences operational productivity

Hypothesis statement 2: Technology influences operational productivity

Hypothesis statement 3: Management influences operational productivity

Hypothesis statement 4: Human resource influences operational productivity

Hypothesis statement 5: Capital influences operational productivity

Hypothesis statement 6: Ergonomics/Safety influences operational productivity

**Table 4.13: Hypothesis testing**

Hypothesis	Coefficient P-Value	t statistic	Conclusion
H <sub>1</sub> : There is no significant relationship between quality and operational productivity H <sub>1a</sub> : There is a significant relationship between quality and operational productivity	P=0.000<0.05	6.684	Reject H <sub>1</sub> , Accept H <sub>1a</sub>
H <sub>1</sub> : There is no significant relationship between management and operational productivity H <sub>1a</sub> : There is a significant relationship between management and operational productivity	P=0.014<0.05	2.053	Reject H <sub>1</sub> , Accept H <sub>1a</sub>
H <sub>1</sub> : There is no significant relationship between technology and operational productivity H <sub>1a</sub> : There is a significant relationship between technology and operational productivity	P=0.001<0.05	3.491	Reject H <sub>1</sub> , Accept H <sub>1a</sub>
H <sub>1</sub> : There is no significant relationship between human resource and operational productivity H <sub>1a</sub> : There is a significant relationship between human resource and operational productivity	P=0.004<0.05	3.099	Reject H <sub>1</sub> , Accept H <sub>1a</sub>
H <sub>1</sub> : There is no significant relationship between capital and operational productivity H <sub>1a</sub> : There is a significant relationship between capital and operational productivity	P=0.168>0.05	2.540	Accept H <sub>1</sub> Reject H <sub>1a</sub> .
H <sub>1</sub> : There is no significant relationship between ergonomics and operational productivity H <sub>1a</sub> : There is a significant relationship between		2.667	Accept H <sub>1</sub> .

ergonomics/safety and operational productivity	P=0.902>0.05		Reject H <sub>1a</sub>
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**Source: Research data (2010)**

In the last section of the questionnaire, respondents were required to indicate the challenges that the small and medium sized manufacturing firms face in their attempt to achieve optimal operational productivity. Results indicate that overall, they all experience the problem of power outages and high rising costs of electricity and petroleum products. The agro-based firms pointed out the problem of erratic supply of raw materials as a major challenge. This was attributed to dependence on rain-fed agriculture.



# **CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

## **5.1 Introduction**

This chapter provides a summary, conclusions and recommendations that were deduced from the findings of the study. The overall response rate was good since a representative proportion of the respondent's population was achieved. This was adequate for a normal distribution assumption. Below are the summary of findings and recommendations on the study.

## **5.2 Summary of Findings**

Tabulation 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. Correlation analysis indicated that four of the six independent variables (quality, technology, management and human resource issues had strong correlations among themselves and between them and operational productivity. These, therefore, can be used to predict the level of the dependent variable (operational productivity) as there was no problem of multicollinearity amongst them apart from their strength level.

The coefficient of determination  $R^2 = 67.06\%$  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 explain 67.06 percent of the variations in operational productivity hence the regression model was significant. The analysis of each variable indicated that quality ( $p=0.000<0.05$ ) is statistically significant at the 5% significance level. Similarly, technology,  $p=0.001<0.05$ , and management with  $p=0.004<0.05$  are statistically significant at 5% significance level. Human resource issues also was statistically significant at 5% confidence level indicating that these variables could be used to predict the level of operational productivity in manufacturing concerns. These

findings concur with findings from a study by Wilson (2005) that motivating factory workers improves their morale and productivity.

However, capital and ergonomics/safety were not statistically significant and hence cannot be useful in the model as they are not good predictors of operational productivity levels. Ergonomics/safety ( $p=0.304>0.05$ ) and capital ( $p=0.168>0.05$ ) should therefore be dropped from the regression model. More specifically the independent variables were ranked as follows in order of their increasing contribution to operational productivity: quality, technology, management and human resources.

### **5.3 Conclusion**

The study concluded that quality, technology, management and human resource issues were the main factors influencing operational productivity amongst the surveyed small and medium sized manufacturing firms. High operational productivity in manufacturing firms inevitably results in lower prices of goods and/or higher quality of goods. When quality is emphasized and subsequently improved, waste is decreased or eliminated, hours are not wasted reworking products, and materials are not wasted. Costs of operations are reduced on the whole. At the same time, the customer receives products and services that he needs at a price he is pleased to pay and at a cost the firm can contain competitively. Moreover, the lowered prices resulting from the productivity gains stimulate an increase in the firm's market share.

The government, manufacturing industry and all stakeholders should ensure that all the factors that were considered significant in this study are emphasized in small and medium manufacturing concerns.

### **5.4 Recommendations**

The following recommendations were made for improvement and further study:

### **5.4.1 Recommendations for Improvement**

From the study findings, the study makes the following recommendations. First, for small and medium sized manufacturing firms to improve their operational productivity, they should enhance their human resources through provision of skills, incentives and motivation to reduce layoffs and high turnover. This should be done in tandem with improvement efforts in quality of their output through reduction in scrap level, reduction in defective products and returned products, enhanced product characteristics and conformance to specifications. Firms should also adopt state-of-the-art manufacturing and information technology. Measures to improve planning and coordination of production activities together with supervision of staff and control of raw materials must also be put in place. The study also recommends that the government should give manufacturing firms incentives such as tax cuts when procuring the latest manufacturing equipment as an incentive for them to adopt state-of-the-art technology.

In order to curb the challenge posed by rain-fed agriculture, this study recommends that the government together with stakeholders in the agro-based manufacturing sector should consider the possibility of irrigation based agriculture. To address the challenge posed by power outages, the study recommends that the government invests in alternative sources of power such as geothermal power. This will ensure a continuous supply of energy and reduce dependence on hydroelectric power which is subject to weather fluctuations.

### **5.4.2 Recommendations for Further Research**

This study focused on establishing the factors affecting the operational productivity of the small and medium sized manufacturing firms in Kenya and establishing the challenges facing small and medium sized manufacturing firms in achieving optimal operational productivity. Further research could be done on this aspect on the large manufacturing firms to determine the factors that drive operational productivity. A replication of this study could be carried out in the service industry. Such a study would be important in highlighting the competitive factors that firms need to consider in order to improve their operational productivity.

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## APPENDICES

### APPENDIX I: INTRODUCTION LETTER

Dear Respondent

This questionnaire is designed to gather information on **“the factors affecting operational productivity in the small and medium sized manufacturing firms in Kenya”**

The study is being carried out for a management project paper as partial fulfillment of the degree of Master of Business Administration (MBA) of the University of Nairobi. The information you shall avail will be treated with confidentiality and that in no instances will your name be mentioned in this research.

Your assistance in facilitating the same will be highly appreciated. A copy of this research paper will be made available to you upon request.

Thank you in advance.

Yours sincerely,

.....  
Francis Kinyua  
Student

.....  
Peterson Magutu Obara  
University Supervisor



## APPENDIX II: QUESTIONNAIRE

### SECTION A

#### ORGANIZATION BACKGROUND

1. Name of your organization (optional).....
2. Position of respondent in the firm.....  
.....  
.....
3. How many branches does your firm have within Kenya?.....  
.....  
.....
4. How many branches does your firm have outside Kenya?.....  
.....  
.....

### SECTION B

1. Does your firm compare output level (production) with input level (resources used)?  
(Please tick)  
Yes                        No
2. To what extent have the following factors affected the ratio of your firm's production (goods produced) to the resources (such as raw materials, machine hours, labour hours) used in the production process?

Factor	V e r y S m a l l E x t e n t	S m a l E x t e n t	N o r m a l	L a r g e E x t e n t	Very Large Extent

The level of education of workers					
The skills of workers					
The total number of hours worked by employees					
New workers					
Incentives to employees (such as bonuses and pay increments) for exceeding set production levels					
Availability of technical workers such as machine operators					
Availability of IT workers					
Employee turnover					
Layoffs which include retrenchment, downsizing and casualisation					
Availability of capital for manufacturing operations					
Availability of capital for purchase of production equipments such as machines.					
Availability of capital for upgrade of equipment.					
Availability of capital for purchase of spare parts					
Supervision of staff in the production department					
Planning of production activities					
Co-ordination of production activities					
Control of production materials					
Selection of new capital investment					
Use of computers in your manufacturing work.					
The presence of the firm's website					
The incidence of computer viruses					
The advertising of your products in the Social Networking Sites (SNS)					
The level of automation of your manufacturing work.					
The firm's processing technologies					
The firm's product design technology					

Product characteristics such as functionality, reliability, and aesthetics					
Conformance to specifications of products					
Standardization of your firm's products					
Customization of your firm's products					
Frequency of defective products					
Frequency of returned products					
The level of scrap					
Production equipment breakdown					
Delay in delivery of spare parts of production equipments					
Motions, reaches and travel distances of a job within a workstation					
Searching for lost or misplaced items					
Machine or equipment set-up time					
Occurrence of accidents in the production department					

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

**SECTION D**

State the challenges that your firm faces as you attempt to increase the ratio of production to the resources utilized in the production

process.....

.....

.....

.....

.....

.....

**Thank you very much in advance for your kind assistance**