

**THE RELATIONSHIP BETWEEN WORLD CLASS
MANUFACTURING PRACTICES AND OPERATIONAL
PERFORMANCE OF STEEL MILLS IN KENYA**

BY

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DECLARATION

This 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 dear family, Kioko's - for the love and vitality that they give to our lives

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They say it takes a village to raise a child, I feel the same way about doing this project.

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ABBREVIATIONS AND ACRONYMS

BPR	Business Process Re-engineering
BPI	Business Process Improvement
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CCR	Capacity Constraint Resource
CIM	Computer Integrated Manufacturing
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
FMS	Flexible Manufacturing System
JIT	Just In Time
KAM	Kenya Association of Manufacturers
MRP	Material Requirements Planning
MRPII	Manufacturing Resource Planning
OM	Operations Management
QC	Quality Circles
SCM	Supply Chain Management
TOC	Theory of Constraint
TPM	Total Productive Maintenance
TQM	Total Quality Management
WCM	World Class Manufacturing

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ABSTRACT

The main objective of this study was to determine the relationship between world class manufacturing practices and operational performance of steel mill firms in Kenya. To achieve this, specific objectives were to determine the WCM Practices in application, to determine enhancement of Operational performance from adopting WCM practices and to determine the benefits and challenges of adopting WCM practices by steel manufacturing firms in Kenya. The study adopted a descriptive cross sectional design which was appropriate because conclusions used objective measures and made generalizations possible based on the information provided at the time of enquiry. The study used primary data questionnaires and analysis was carried out using SPSS Software. The study targeted twenty (20) respondents and the responses was 13, a response rate of 65%. The main world class manufacturing practices identified were total quality management, total preventive maintenance, employee involvement, lean manufacturing and others such as electronic data interchange, supply chain management, material requirement planning and material resource planning. The findings revealed that there was a strong positive relationship between world class manufacturing practices and world class operational performance at R (0.946). The findings on the challenges experienced in the adoption of world class manufacturing observed that insufficient justifications and lack of quantifiable evidence are the main obstacles to convince executives to adopt these practices. The benefits of integrating world class manufacturing include increased competitiveness, development of new and improved technology and innovation. The recommendations is steel milling firms in Kenya should adopt full implementation of World class manufacturing practices to experience and attain world class status.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

World class manufacturing is, according to Jacobsen (1996), an umbrella term for a variety of forms of work organisation; managerial and manufacturing techniques; processes; and systems, each of which has as its underlying capacity for increasing the flexibility of an enterprise. World class manufacturing is generally considered to be existent where a number of such elements are combined to address an enterprise's need for flexibility, including considerations of technology, process and personnel. Undoubtedly, WCM offers increased opportunities for economic development and plays a crucial role in rapid economic change, productive capacity improvements and international competitiveness enhancement for developing countries in general and Egypt in particular (Mora-Monge et al., 2008). WCM is an important tool to address some of the key barriers and challenges for entering the global economy and for future growth potential. It can transform old challenges and create unprecedented possibilities for sustainable economic development, just as it has done for businesses in the industrial world. Initially American owned firms such as Apple, Power Conversion Europe, Abbott Ireland, Northern Telecom and Thermo King, led the field. (Amanda, 1999).

The theory of constraints is the brain child of Israeli physicist Eliyahu Goldratt (1999). It is a process improvement philosophy that looks at an organization as a system. Its primary principal is that all complex systems are governed by inherent simplicity, that at all times there are very few factors that actually dictate the outcome of a system. Theory of Constraints is holistic approach that allows the company to identify the few physical and logical leverage points in an organization; how they can be used to address the fundamental core problems at the root of the symptoms where improvement can quickly cause quantum improvement for the organization as a whole (Goldratt, 1996). The cumulative capability theory proposes effective guidelines for the building of multiple capabilities (Noble, 1995). Originally introduced by Nakane (1985), the cumulative capability theory posits that companies should develop capabilities not just sequentially, but according to a predetermined sequence.

The consumption of steel in the world has been steadily increasing over time. In Kenya, the recent increase in economic growth has also resulted in increased steel consumption. The increased economic growth has been driven by increase in volumes rather than improvement in efficiency and productivity. While information on the Kenyan steel industry exists, it is scattered among numerous sources and therefore it is not easily accessible. Data from the Kenya National Bureau of Statistics indicates that steel imports have grown by more than 100 per cent in the past five years from \$263 million to \$538 million while Kenya's annual demand for steel is estimated at about 480,000 tonnes to 600,000 tonnes (African business review and technology, 2012)

1.1.1 World Class Manufacturing Practices

The focus on WCM was first conceptualized by Heyes (1984) as a distillation of insight gained from Japanese manufacturing in the 1970's when western manufacturing was perceived as failing and unable to compete. It was seen to provide a new form of accountability and control that more faithfully represents the nature and causal processes of manufacturing. It has a strong focus on accountability to the customer and monitoring progress according to benchmarks derived from principles and practices of the best manufacturers internationally to engage the minds of managers and employees alike. Such a perspective of WCM depicted a distaste of management accounting. According to World Class International (1996), world class business is "organized to serve the customer" but to do so it must return to the basics: continual and rapid improvement in serving customers through better quality, lower cost and quicker and more flexible responses. The emphasis is how WCM techniques mesh together.

WCM determines which set of activities needs to be undertaken by identifying what is needed by the companies to compete globally. Moreover, WCM itself involves many factors systematically related to production, for example, raw materials, energy, machinery, labour, and management. Furthermore, World Class companies optimise the problem solving abilities of their employees in applying both modern techniques and traditional engineering process (Hayes and Wheelwright, 1984). WCM is composed of six dimensions: workforce skills and capabilities, management technical competence, competing through quality, workforce participation, rebuilding

manufacturing engineering, and incremental improvement approaches Salaheldin (2007). Schonberger (1987) used it to refer to many techniques and technologies designed to enable a company to match its best competitors. These techniques includes for example, JIT, quality circles (QC), Kanban, material requirements planning (MRP), flexible manufacturing system (FMS), computer aided design (CAD), computer aided manufacturing (CAM), computer integrated manufacturing (CIM), manufacturing resource planning (MRPII), total quality control (TQC), total productive maintenance (TPM)/Preventive Maintenance, TQM, simultaneous engineering, benchmarking, intelligent manufacturing, electronic commerce, business process re-engineering (BPR), enterprise resource planning (ERP), electronic data interchange (EDI) and supply chain management (SCM).

Buckner (2003) identified four practices that characterize a world class manufacturer: an on-going companywide education and training initiative for human resource development to allow everyone to actively participate in the improvement process. Studies have shown that World Class Manufacturers provide a minimum of forty hours of education and training per employee on an annual basis; relentless pursuit of continuous improvement in all business activities. The management focus is on establishing operating performance measurements that drive the behaviours consistent with global continuous improvement in both process and product; dedication to developing a competitive advantage based on superior quality and service. The world Class Company creates a level of customer satisfaction through being not only 'easy to do business with', but by exceeding customer expectations; utilization of an integrated business system that links people and processes.

1.1.2 Operational Performance in World Class Manufacturing

Operational performance has been conventionally characterized in terms of competitive priorities of operations strategy (Narasimhan and Das, 2001). The term competitive priority was first introduced by Hayes and Wheelwright (1984) as the strategic preferences or dimensions from which a company chooses to compete. Operational performance is an important aspect of management (Panupak & Robert, 2008). Performance is achieved when an organization successfully achieves a competitive edge over its competitors by using quality, cost, speed, and flexibility (Dangayach & Deshmukh, 2001). These are best practices that lead to increased

operational performance and which, if a company decides to abandon may lead to poor performance (Ward & Duray, 2000; Camp, 1989). These capabilities are applied to contribute to overall performance (Anderson, Schroeder & Cleveland 1991; Meredith & Vineyard, 1993; Ramanujan & Venkatraman, 1987).

According to Hayes and Wheelwright (1984), the keys to world class manufacturing dictates a requirement to deploy capabilities to improve manufacturing operations and processes. The use of world class best practices such as JIT, TPM, TQM in the manufacturing strategic framework represents both decisions and actions which help in the achievement of the operational performance. There is need to adapt an innovative culture in order to continuously improve products to meet customers' changing tastes and preferences.

Quality, cost, delivery reliability, lead time, flexibility and employee relationships are the six factors identified by the Maskell (1991) as the key elements of WCM commonly used by the world class companies. Flynn (1994) recommended top management support, quality information, process management, product design, work force management, supplier involvement and customer involvement as the key performance measures of WCM. However, the authors suggested manufacturing cost, employee empowerment, flexibility and speed as additional performance measures of WCM.

1.1.3 Steel Manufacturing in Kenya

In Kenya's metal industry operations are in steel smelting and hot rolling, manufacture of wire and wire products, pipes, galvanized and cold rolled steel products. These sub-sectors are interrelated as they depend upon each other for the supply of inputs. Since steel is a major raw material for most industries, high growth in the steel industry is expected. This makes it important to investigate the dynamics of the steel industry in the country. Furthermore, the Kenya Government Launched 'Vision 2030'. This is a road map on how the country will transform into an industrialized middle income state by the year 2030 (Kariuki, 2011)

Steel industry is one of the key subsector in infrastructure development. Kenya's annual demand for steel is estimated 480,000tonnes to 600,000 tonnes, with most of the iron to make steel being imported from South Africa, Japan, India and China. The local steel

sector makes a variety of products from local and imported steel scrap, steel billets, and hot rolled coils. The country imports and exports steel billets, coils, wire rods, steel plates, sheets and pig iron. Most of the steel products are being sold on the domestic market, however mainly by the construction industry. (African business review and technology, 2012).

Steel companies have also benefit from the wider East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA) markets. “Statistics show that metal and steel products are currently Kenya’s largest manufactured goods exported within the COMESA and the EAC”, said Betty Maina (2012), chief executive officer at the Kenya Association of Manufacturers. Steel from Kenyan companies is being bought by Rwanda, Tanzania, Uganda and Democratic Republic of Congo. The major Kenyan steel dealers include Athi River Steel Ltd, Brollo Kenya Ltd, Devki Steel Mills Ltd, and Accurate Steel Mills Ltd. (African business review and technology, 2012).The use of WCM critical practices such as employee involvement, total productive maintenance, quality focus, elimination of waste, can improve organizational business performance visibility, improved throughput with all this aimed to satisfy and exceed customer expectations (Davies, 2002)

1.2 Research Problem

World class manufacturing is a fundamentally different way of operating an organization, rather than a set of techniques (Hall, 1998), while Giffi, Roth and Seal (1990) view quality and the customer as the primary focus of world-class manufacturing, supported by a combination of manufacturing strategy and capabilities, management approaches, organizational factors, human assets, technology and performance measurement. In recent times successful organizations in business will need to obtain global competitive advantage through use of their manufacturing capabilities as a strategic weapon. A number of critical practices with WCM, including development of the workforce, developing a technically competent management group, competing through quality, stimulating worker participation on and investing in state of the art equipment and facilities would be the future direction (Barbara et al, 1997).

The Kenya steel Industry has continued to grow significantly despite the numerous challenges it has faced over the years. The industry is bedeviled with challenges of

limited market diversification, high cost of raw material and energy, limited world class technology for doing steel business, limited value addition to the local steel firm with reliance to traditional manufacturing technologies. The above cited challenges propel the industry to take a paradigm shift if it is to remain competitive in the global steel market. Steel firms in Kenya operates within these tough market conditions with increased intensity in competition, very challenging external environment, economy's slowdown, growing complexities in running the business, and all these challenges have propelled the organization to adopt world class manufacturing philosophies to give it an upper edge in the global competition in the market. This study aimed at finding out the relationship of WCM practices and operational performance in steel firms in Kenya.

Related studies have been done on WCM, Salaheldin (2007) the implementation of world class manufacturing techniques in Egypt identified that WCM has emerged as a result of many business drivers, the changes in the driving forces for manufacturing strategy to achieve savings and improve efficiency, companies have come to be driven by a desire for greater supplier involvement and customer service in later implementation which lead to the adoption of mass customization production philosophy. Makena (2013) on factors that influence the implementation of WCM techniques in Edible Oil Industry in Kenya concluded that Critical factors considered to drive WCM in organizations were, effective product design, statutory compliance, linkage with employees, developing leadership skills, reducing wastes in process and improving safety for employees. Ngeta (2013) a survey of implementation of world class manufacturing practices in the case of listed companies argued that Implementation of WCM enables firms to react quickly to changes in customer demand, and thus carry lower levels of inventory, improve cost efficiencies, increase the flexibility of production facilities through use of planning and scheduling software, exactness, precision, responsiveness and repeatability to delight the customer. While the issue of world class manufacturing is sparse, the researcher is not aware of any study carried out to determine the relationship between WCM practices and operational performance in Kenya, bearing in mind that steel is a key export sector in Kenya. This study sought to address this gap by answering to the following research question: Does world class manufacturing practices have a relationship with operational performance in the steel mill firms in Kenya?

1.3 Research Objectives

The research objectives of this study were to:

- i. Determine the relationship between WCM practices and operational performance of steel mill firms in Kenya.
- ii. Determine the benefits of WCM practices use and application by steel manufacturing firms in Kenya.
- iii. To determine the challenges of adopting world class manufacturing practices by the steel mill firms in Kenya.

1.4 Value of the Study

The findings of this study can be important to policy makers as it may help them formulate policies that can steer the government to put in place appropriate infrastructure that may empower manufacturing firms to adopt world class manufacturing practices in order to remain competitive in the global market. Moreover, with the world becoming a global village, even the small scale entrepreneurs “Jua Kali” industry may need to be empowered to join forces to qualify being branded as world class organizations.

The report can be of great value to practitioners in the industry, it will help understand the various world class manufacturing practices adopted in the manufacturing industry. The report will also act as a motivation to the industry players to adopt specific world class manufacturing practices to strategically position themselves in the competitive business environment.

The academic fraternity may find the report important in helping them understand world class manufacturing practices in the manufacturing sector. In effect it will open up research and study opportunities in areas not adequately covered in the report.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter represents relevant review of literature on the study topic. The chapter begins with the theoretical foundation of the study, world class manufacturing practices, benefits of WCM, challenges of WCM, Operational Performance in WCM and summary of the study.

2.2 Theoretical Foundation of the Study

This chapter defines theoretical foundations in which this study is based on three theories which are considered most central, namely theory of constraints, cumulative capability theory and trade-off theory.

2.2.1 Theory of Constraints

The theory of constraints (TOC) developed by Goldratt is based on the principle that complex system made up of thousands of people and pieces of equipment can have only a small number of variables that limits the ability to generate more the system's goal (Goldratt,1996). Theory of constraints primary objective is to manage potential internal and external constraints, no matter where they may occur, so that they do not become bottlenecks or limits on achieving throughput goals.TOC identifies capacity constrained resource (CCR), that is, any resource that is likely to compromise the throughput of the organization if its capacity is not carefully managed. External market constraint is where insufficient demand for the product or service inhibits the full consumption of what is produced.TOC complements lean/JIT's continuous improvement activities and six sigma emphasis on determining how to reduce variation in the system. Behaviour based constraints occur when people lack understanding of the causes and effect of problems, and when they fail to know where to start making improvement (Shams-ur 1998). Alleviating the first problem (by finding the cause) is a prerequisite to making the improvements. World class organizations are adapting a learning culture as a way of overcoming the people constraint by equipping them with necessary skills that reduce accidents and machine breakages.

2.2.2 Cumulative Capability Theory (Sand Cone Theory)

The cumulative capability theory or the 'sand cone' model by Ferdows and De Meyer (1990), improves manufacturing performance in a cumulative manner and the sequence advocates that manufacturers acquire quality, followed by delivery, flexibility and finally cost. Global competition has intensified the pressure on plants to improve along all four dimensions. According to Vokurka and Davis (2004), world class manufacturers are those that demonstrate industry best practice. To achieve this, companies attempt to be best in the field at each of the competitive priorities (quality, price, delivery speed, delivery reliability, flexibility and innovation).

The sand cone model (Ferdows & De Meyer 1990; Noble 1995) and the competitive progression theory (Roth, 1996) argue that, to become excellent along multiple dimensions, companies should develop capabilities in a pre-specified sequence. Organizations therefore aim to maximize performance in these areas in order to maximize competitiveness. However, as resources are unlikely to allow improvement in all areas, organizations concentrate on maintaining performance in 'qualifying' factors and improving 'competitive edge' factors. The priorities will change over time and must therefore be reviewed.

2.2.3 Trade Off Theory

Skinner (1969, 1974) proposed the trade off model in a series of conceptual studies. His work calls for managers to choose their plant's competitive priority, then design and operate the manufacturing system accordingly, concentrating efforts on developing assets and practices that help achieve their goals. Plants should focus on one priority at a time, because cost, flexibility, quality, and delivery capabilities require different operational structures and infrastructures for support and thus trade one measure against another.

Hayes and Wheelwright (1984), further stress the importance of focused manufacturing. It is difficult (if not impossible) and potentially dangerous for a company to try to compete by offering superior performance along all of these dimensions, since it will probably end up second best on each dimension to some other company that devotes more of its resources to developing that competitive advantage. The common characteristic among 'world class manufacturers' lean manufactures and agile manufacturers are their ability to excel and compete on several aspects of performance simultaneously. Even as a customer, we expect multiple attributes from a

product or a service simultaneously, such as high quality at a reasonable price, safety as well as speed, and ease of use with a multitude of features. Thus, both the customer expectations and manufacturers' competitive strategies seemingly defy the notion of trade offs.

Trade off theory studies examine the need for plants to prioritize their strategic objectives and devote resources to improving those manufacturing capabilities. For example, plants must make choices between achieving low costs or high flexibility. Low cost producers seek to reduce waste and improve productivity, often designing efficient line flow systems comprised of relatively fixed machinery and standardized operator tasks. In contrast, highly flexible plants may choose a job shop design, seeking rapid response to changing customer demands and product specifications.

Trade-off theory has thus been out-dated by world class manufacturing principles. "World class manufacturers" set the standard, developing capabilities that reinforce one another. The most quoted example is of high quality enabling plants to become more responsive to customer needs (flexibility), more reliable (delivery), and more efficient (cost) (Schonberger 1990; Szwajczewski, Mapes, and New 1997). Advanced manufacturing technology, flexible manufacturing systems, computer integrated manufacturing, and other programmable automation helps plants develop multiple capabilities simultaneously and thus the development of cumulative capability theory

2.3 World Class Manufacturing Practices

The term "world class manufacturing" has been first introduced by Hayes and Wheelwright (1984). Since, then, various researchers have embraced and expanded this concept. WCM determines which set of activities needs to be undertaken by identifying what is needed by the companies to compete globally. Moreover, WCM itself involves many factors systematically related to promotion, for example, raw materials, energy, machinery, labour, and management. Furthermore, World Class companies optimize the problem-solving abilities of their employees in applying both modern techniques and traditional engineering process (Jaideep, 1998).

According to Hayes and Wheelwright (1984), WCM is composed of six dimensions: Workforce skills and capabilities, management technical competence, competing through quality, workforce participation, rebuilding manufacturing engineering, and incremental improvement approaches. By comparing the practices of Japanese and German manufacturers with US manufacturers, Hayes and Wheelwright claimed that the US plants must focus on these six broad categories of practices in order to achieve their WCM status. Schonberger (1986) provided a list of sixteen principles of WCM which fall into eight categories: general, design, operations, human resources, quality and process improvement, information for operations and control, capacity, promotion and marketing. Schonberger actually asked managers to evaluate their own plants based on these sixteen principles. He warned those plants that scored low on the sixteen principles to identify their problems and make an effort to improve these practices to keep up with the competition.

TQM is a philosophy in which management improves operations throughout the value chain to deliver products and services exceed customers' expectations. It is an unyielding and continuous effort by everyone in the firm to understand, meet and exceed the expectations of the customers. Organizations develop their own approach to total quality management to suit their particular culture and management style (Hommes, 2000). Total Quality Management encompasses designing the product or service to meet the needs and wants of the customers, as well as making products with zero defects and waste and with low inventories.

TPM is designed to maximize equipment effectiveness improving overall efficiency. by establishing a comprehensive productive-maintenance system covering the entire life of the equipment, spanning all equipment related fields planning, use, maintenance and, with the participation of all employees from top management down to shop floor workers, to promote productive maintenance through motivation management or voluntary small-group activities (Tsuchiya, 1992). TPM provides a comprehensive company wide approach to maintenance management which is usually divided into short term and long term elements. In the short-term, attention is focused on an autonomous maintenance program for the production department, a planned maintenance program for the maintenance department, and skill development for operations and maintenance personnel. In the long term, efforts focus on new equipment design and elimination of sources of lost equipment time.

Lean is about eliminating “waste” from the production system (Shingo, 1989; Womack , 1990; Womack and Jones, 1996) and yet be able to produce products of the highest quality that satisfies the ultimate customers. As Shingo (1989) aptly remarked, 80 percent of lean is about waste elimination and the balance about system. Waste, often called muda, in Japanese, comprises seven types of common waste: over production, unnecessary motion, excess inventory, excess transportation, rejections/rework, waiting, and over processing (Cachon and Terwiesch, 2009). Apparently, elimination of these wastes looks straight forward, yet their identification is often difficult in most organizations.

World class organizations must be managed by world class agile management systems in order to be successful. Such management systems are reprehensive and proactive in pursuit of achieving their goals and objectives and highly value their customers and employees. They are “people oriented organizations”; and they cherish close communication with their employees and customers. Thus, this discussion focuses on one major characteristic of a world-class agile management system, namely its employees' involvement and human resources development. The driving force behind employee involvement and human resource development is good communication. Figure 1 shows the strategic importance of communication and employee involvement in a world class company.

2.4 Benefits of World Class Manufacturing

According to Mapic (2003). There are seven keys of which impact a manufacturing organization and its competitiveness. Shorter lead times are always a good thing in many markets the ability to deliver soon will win businesses away from competitors with similar product features, quality and price. Costs are a part of score board when Companies implement WCM operational processes it improves multiple measures simultaneously including costs, lead time and customer service. Since material cost is dominant significant opportunities for reduction lie in analyzing current spending and devising effective sourcing strategies for material, overhead reduction is always a fertile area by using automation to streamline procurement, manufacturing and customer management process. A well implemented and effective business solution delivers

overall visibility into the health of a company and its operation provides detailed information for performance measurement, process management and problem identification and on-going feedback. Speed to Market benefits with WCM implementation, exceeding customer expectations. Manage a global enterprise by design of products that appeal to international markets, search for suppliers in other geographies. WCM lead to unlocking potential in order to manage and excel in certain markets.

The benefits of integrating world class manufacturing include increased competitiveness, development of new and improved technology and innovation, increased flexibility, increased communication between management and production employees, and in work quality and workforce empowerment. This, in essence, translates to increase in operational performance. One of the concepts used in WCM is lean management, which focuses on continuous improvement by way of eliminating wastes (Imathiu 2014).

According to Salaheldin and Eid, (2007) WCM has emerged as a result of many business drivers. Firstly, the changes in the driving forces for manufacturing strategy, from an initial push to improve current business processes to achieve savings and improve efficiency, the companies have come to be driven by a desire for greater supplier involvement and customer service in later implementation which lead to the adoption of mass customization production philosophy. Secondly, competitors' use of the WCM techniques and response to customers also has a strong effect on the adoption of the most advanced WCM techniques for the production purposes. Thirdly, as a result of its growing ability to bring new opportunities and to facilitate the development of the new organizational forms and structures needed to meet the continuously emerging changes in business imperatives, the WCM importance increases as it becomes involved in each task in today's business. Finally, Information Technology developments are also forcing organizations to be up- todate in their use of advanced technologies regarding delivery of speedy and high quality information, as well as facilitating greater degrees of communication and integration across business units and external partners.

Successful TPM implementation which is a WCM programs have contributed towards realization of intangible benefits such as continuous improvement of workforce skills

and knowledge, clarification of the roles and responsibilities for employees, a system for continuously maintaining and controlling equipment and manual work, an enhanced quality of work life, an improved participation rate, and reduced absenteeism caused by stress, and more open communication within and among workplaces (Suzuki, 1994; Carannante, 1995). Greater job satisfaction can translate into higher productivity and quality, and ultimately contributes to lower manufacturing costs (Hamrick, 1994). Companies need to consider the human aspect of TPM in combination with the technical and financial impacts.

2.5 Challenges of World Class Manufacturing

In order to provide some insight into the common causes of partially failed initiatives and what can be thought of as the barriers to successful implementation of WCM, literature from the fields of manufacturing, management and information systems are critically reviewed. These fields are selected because of the considerable bodies of work that deal with process improvement, change management, information systems implementation and production systems.

WCM is crucial to competition, because the techniques and resources it combines can create new opportunities. Such an approach is given added impetus by rapid technological changes and fierce competition, requiring Egyptian manufacturers to consider the adaptation of modern techniques which can be classified under the overall umbrella term of WCM. Salaheldin and RiyadEid, (2007), however, many authors have argued that WCM has a number of limitations that are needed to be addressed in the manufacturing strategy (Hollensen, 2001; Porter, 2001; Skinner, 1999). When implementing the WCM techniques, there may be different barriers: such as partial implementation of WCM techniques (Becker, 1993), overly optimistic expectations (Doyle, 1992) and implementation of WCM to conform to societal norms rather than for its instrumentality (Campbell, 1994). However, some of the prominent problems in WCM practice include partial implementation, lack of a well defined routine for attaining the objectives of implementation, cultural resistance to change, lack of training and education, and lack of organizational communication (Crawford., 1988; Becker, 1993). These problems reflect the lack of a clear understanding of what are the fundamental and complementary manufacturing practices.

It can also be inferred that companies that encountered failure in their program implementation neglected the development of practices that support the implementation of WCM techniques. Moreover, Safayeni et al. (1991) contend that failure of WCM implementation is partly due to confusion over what exactly constitutes WCM and its implementation within an existing organization structure that does not provide the necessary support. The major barrier that will possibly affect WCM implementation is the inability of a company to coordinate its human resource practices, management policies and technology (Fredendall et al., 1997). Together, these problems reflect the lack of a system that supports the implementation of WCM programs.

2.6 Operational Performance in World Class Manufacturing

According to (Voss, 1995) the companies which have achieved world class status have adopted best practices and achieved high performance in operational areas through implementing best practices. Operational performance is actualized when organizations optimally utilize their capabilities such as high levels of quality, reduced operational costs, truncated product's cycle, and speed to the market and flexibility to gain competitive advantage (Dangayach & Deshmukh, 2001). In studies done by Camp (1989) stated that a neglect of these tenets leads to poor operational performance while according to Davies and Kochhar, (2002) a world class manufacturing is associated with best practices which in turn lead to high performance .

One of the concepts used in WCM is lean management, which focuses on continuous improvement by way of eliminating wastes, total productivity maintenance (TPM), manufacturing excellence, all of which deliver operational productivity was defined by Hayes and Wheelwright (1984) and Schonberger (1986) as a competitive strategy employing the best practices in quality management, lean production, and concurrent engineering (Fullerton & McWatters, 2004). Gunn (1987) emphasizes on the role of technology in operational performance. Hanson and Voss (1993) observed WCM in terms of practice and performance. WCM optimizes the problem solving abilities in employees by applying both modern techniques and traditional engineering process (Salaheldin & Eid, 2007). Manufacturing practices like Just in Time, Total Quality Management in manufacturing have significant effect on operational performance (Hayes & Wheelwright, 1984). From review of operational performance literature (Dangayach & Deshmukh, 2001). Hill (1993) argues that every company must

determine the criteria upon which it will operate against its competitor while its order-winning criteria include price, delivery, quality, product design and variety.

Saraphet *et al.* (1989), Black and Porter (1996) identified critical factors of quality management the role of management leadership and quality policy, quality department, training, product/service design, supplier quality management, process management, quality data and reporting, employee relation and customer focus. Quality, cost, delivery reliability, lead time, flexibility and employee relationships as the six factors identified by the Maskell (1991) as the key elements of WCM commonly used by the world class companies. Flynn *et al.* (1994) recommended top management support, quality information, process management, product design, work force management, supplier involvement and customer involvement as the key performance measures of WCM. However, the authors suggested manufacturing cost, employee empowerment, flexibility and speed as additional performance measures of WCM. Kasul and Motwani (1995) identified nine critical factors for world class operations namely management commitment, quality, customer service, vendor and material management, advanced technology, facility control, flexibility, price/cost leadership and global competitiveness. Seven critical factors for environmental management namely top management. According to the authors, there is a need to focus on environmental issues for improving the performance of organization. Utzig (1988) has suggested the following list of operating measures for advanced manufacturing lead time, total value-added versus non-value added time and cost, schedule performance, product quality, engineering change notices, machine hours per part, plant/equipment/tooling reliability, cycle time, broad management/worker involvement, problem support, high value added design and forecast accuracy. However, authors such as Hayes *et al.* (1980) proposed only productivity as a measure of manufacturing performance.

2.7 Empirical Literature Review

Riyad (2009) Factors affecting the success of world class manufacturing Implementation in Less developed Countries examined that Egypt Manufacturing firms should consider some factors at the strategic level hence top management should also be personally knowledgeable of the WCM potential and proactively involved in its internal diffusion in order to manage it effectively. Top management support is a pre-

requisite for effective and successful WCM implementation. The quest for achieving a world class status is not a destination but a continuous journey that throws up more and more opportunities for improvement. Improvement should be seen as an ongoing process, in the sense that once targets are met, new ones must be set, aiming for even higher levels of production efficiency.

Jaideep (1994) WCM Practices of North American Manufacturing Organizations examined the extent to which world class philosophy and methods are being practiced by North American manufacturing organizations. The results of this study indicate that these manufacturers are aware of and committed to the basic concepts underlying world class manufacturing status. Some weaknesses in translating philosophy into policies and methods were identified. While these manufacturers report that on average more than fifty per cent 50% of their products' materials are purchased from outside vendors, vendor development plans are viewed as the least important method of vendor quality management. Most rely heavily on internal feedback from production departments to report on vendor quality. Vendor development programmes ensure that materials are production suitable when they come in the door, and reduce the need for internal vendor quality monitoring. Pull-through production systems can significantly reduce inventories but are considered relatively the least important manufacturing control method used in the surveyed businesses.

Makena (2013) on factors that influence the implementation of WCM techniques in Edible Oil Industry in Kenya concluded that Critical factors considered to drive WCM in organizations were, effective product design, statutory compliance, linkage with employees, developing leadership skills, reducing wastes in process and improving safety for employees. Ngeta (2009) a survey of implementation of world class manufacturing practices in the case of listed companies argued that Implementation of WCM enables firms to react quickly to changes in customer demand, and thus carry lower levels of inventory, improve cost efficiencies, increase the flexibility of production facilities through use of planning and scheduling software, exactness, precision, responsiveness and repeatability to delight the customer.

The findings from other WCM studies for example Riyad (2007) indicate that the Egyptian manufacturers are still in the 1970s and 1980s, when compared with world-

class manufacturers and the most important variables that promote the use of WCM techniques are “reduced operating costs (marketing and production)” and “global issues (environment-market).” More importantly, the results of his study indicate that poor planning and lack of knowledge are the most significant barriers to use of WCM practices in the manufacturing sector.

According to Salaheldin et al, (2007) there is a need to empirically explore the benefits of WCM implementation by the Egyptian manufacturing companies. Furthermore, more research is needed to study how the perceived importance of these drivers and barriers may differ across each industry such as manufacturing equipment, chemical and plastics, telecommunications, hardware equipment, textile industry, home equipment, scientific and medical equipment, management consulting, and software development.

2.7 Summary of Literature Review

World class manufacturing standards is an essential step in any enterprise. But it is only one of a number of challenges facing the firm. The prime step is to develop a realistic business strategy in which the firm matches its core competences with the opportunities in the market. This business strategy will have identified the key critical success factors in the final markets (Hollensen, 2001). And it is from these critical success factors that the priorities in adopting world class manufacturing will be identified. If, for example, it is quality, then emphasis will have to be given to the use of those organizational tools which will best deliver high quality at a low cost. Similarly, if lead time to satisfying customer orders is critical, then the emphasis will be placed on altering production-flow, and reducing batch sizes and inventories.

Many writers in operations management have focuses on the area of WCM since the works of Hayes and Wheelwright in 1984, Gunn in 1987 and Hall in 1983. But from the review of literature only a few studies on WCM in less developed countries have been done. Most Kenyan Industrial firms in the manufacturing sector are involved in both regional and international trade; it is therefore prudent to investigate what are the WCM manufacturing techniques being used along with corresponding benefits with the view of determining the current state of affairs so as that the information can be useful to reinvigorate the industry manufacturing and compete at the global arena.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter details the methodology employed in conducting this study. It covers research design, population of study, data collection and data analysis.

3.2 Research Design

A descriptive cross sectional design was used in this study to examine world class manufacturing practices in the steel mills in Kenya. A cross sectional study involves data being gathered just once, perhaps over a period of days or weeks or months in order to answer a research question, (Cooper and Schindler, 2011). This approach allows for analysis of opinion of management in providing insight into the extent of the adoption of world class manufacturing practices

3.3 Population of Study

According to the KAM directory (2015), there are 20 steel manufacturing firms in Kenya (as listed in Appendix 2) and all these companies were studied. It follows therefore a census, Churchill (1991) says census survey involves collection of data from all members of the population.

3.4 Data Collection

A questionnaire was used as the main data gathering instrument for this study. The questionnaires were administered to the Maintenance Managers, Production Managers, and Plant/Operations Managers. This method was preferred as it is the most feasible way of reaching all the respondents. The questionnaire is divided into five parts. Part one include queries which are general in nature and was used to gather some basic information about the firm. This would be useful in categorizing the firm as either large or small. The second part, seek to address the objective of establishing the current world class manufacturing practices in use, applications and management practices at the steel mill companies in Kenya. Part three addressed the third objective of examining the operational performance with WCM practices, the fourth benefits of WCM practice while the last part determines the challenges of WCM application at the Steel mill companies in Kenya.

The drop and pick method was chosen because the questions are simplified and unambiguous making it easy for the respondents to answer on their own. Distant companies, questionnaires were sent via postal mail with stamped envelopes provided to be mailed back. Where possible, email is used to administer the questionnaire.

3.5 Data Analysis

After gathering completed questionnaires from the respondents. Descriptive statistics (frequencies, cumulative frequencies, percentages and mean scores) was used to describe and establish the extent to which WCM practices have been adopted and benefits of WCM practices applications at the Steel Mills in Kenya. The analysis was carried out using statistical product and services solutions (SPSS) software. The relationship between WCM practices and operational performance was analysed using regression analysis as follows.

The following regression model used:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \epsilon$$

Where:

Y = Operational performance

a = Constant which represents the level of operational performance without influence of any of world class manufacturing practices

b₁, b₂, b₃, b₄, b₅, Coefficient of X_n which represents the estimate of effect of X_n on operational performance.

X₁ = Total quality management

X₂ = Total productive maintenance

X₃ = Employee involvement

X₄ = Lean manufacturing

X₅ = Other techniques

€ = Error term.

The multiple correlation coefficient R was used to test the strength of the relationship between the independent variables and dependent variable. The strength of the model in explaining the effects of WCM operations practices on operational performance with then be tested using R squared.

3.6 Operationalization of the Study Variables

Independent variables consists of specific WCM operations which are derived from general categories namely total quality management, total productive maintenance, just in time (JIT),employee involvement and lean manufacturing. Dependent variable will be measured in terms of increase in quality, reduced costs, on time delivery and increased flexibility.

Table 3.1 Operationalization of Independent Variable

Independent Variable	Indicators
1. Total Quality Management	<ul style="list-style-type: none"> -Top management leadership -Middle level management leadership -Public responsibility -quality information -Strategy -Employee involvement -Employee training -Employee responsibility -Employee union participation -Company run activity -quality assurance -Process control -Supplier reliability -Supplier involvement -Supplier relationship -bench marking

	-Customer satisfaction
	-customer feedback
	-Customer monitoring
2. Total Productive Maintenance	-Housekeeping such as 5s
	-Cross training of operators
	-Production and maintenance people together in teams
	-Operator involvement
	-Disciplined planning process for maintenance tasks
	-Good information tracking system
	-Scheduled compliance on maintenance programs
3. Employee involvement	-Employee training and education
	-Employee involvement in decision making
4. Lean manufacturing	-Elimination of zero value activities
	- Flexible information system
	- multifunctional teams
	-continuous improvements and zero defects
	-Integration of suppliers
	-JIT techniques production and delivery
5. Other Techniques	-Electronic data interchange
	-Supply chain management
	-Material requirement planning
	-Manufacturing resource planning
Dependent Variable	Indicators
Quality	- High product performance

- High Product variability
- Conformance of final product to design specifications
- Delivery
 - Short time delivery
 - Delivery on due date(ship on time)
 - On-time-delivery
- Flexibility
 - Ability to introduce new products into production quickly
 - Ability to adjust capacity rapidly within a short period
 - Ability to make design changes after production has been done.
- Costs
 - Labour productivity
 - Product cost
 - Reducing inventories.

CHAPTER FOUR

RESULTS, DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents an analysis of data collected and discusses the findings on the effect of world class manufacturing practices on world class operational performance of steel mills in Kenya.

4.2 Demographic Characteristics of the Respondents

4.2.1 Response Rate

From Table 4.1 below of response rate, the results show that out of the 20 targeted respondents, 13 successfully filled the questionnaires. This represents a response rate of 65.0%. This response rate was good and representative and conforms to Mugenda and Mugenda (2003) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

Table 4.1 Response rate

Response	Frequency	Percentage
Response	13	65.00
Non responses	7	35.00
Total	20	100

Source: Research Data (2015)

4.2.2 Respondents Designation in Organization

From Table 4.2 which contains information on the respondents' designation in the various steel mills,, the results show that 1 (7.69%) respondents worked in administration, Health and safety departments and Logistics areas, 6 (46.15%) worked in production areas, 4(30.77%) worked in Engineering . This means that a majority of the respondents could be presumed to have the requisite professional experience that could enable them provide relevant and invaluable information on the topic under study.

Table 4.2 Designation in the organization

Designation in organization	Frequency	Percentage
Administration	1	7.69
Production	6	46.15
Engineering	4	30.77
Health and safety	1	7.69
Logistics	1	7.69
Total	13	100

Source: Research Data (2015)

4.2.3 Organizational ownership

The results in Table 4.3 on organizational ownership established that 7 (53.85%) organizations were locally owned, 7 (7.69%) were multinational while 5 (38.46%) were both locally owned and foreign owned. This means that evidence of world class management was readily exhibited by the presence of foreign and local elements.

Table 4.3 Organizational ownership

Ownership	Frequency	Percentage
Local	7	53.85
Multinational	1	7.69
Both local and foreign owned	5	38.46
Total	13	100

Source: Research Data (2015)

4.2.4 Steel mill firm category

From Table 4.4 on steel mill firm categorization, the study established that 5 (38.46%) of the steel mill firms fell into Rolling mill category, 3 (23.07%) were categorized as Galvanizing and 5 (38.46%) were categorized as both rolling mills and galvanizing. This followed that the information given was deemed balanced since all the categories were included in the study.

Table 4.4 Organizational categories

Category	Frequency	Percentage
Rolling mill	5	38.46
Galvanizing	3	23.07
Both rolling mill and galvanizing	5	38.46
Total	13	100

Source: Research Data (2015)

4.2.4 Respondents company employee size

The results in Table 4.5 on employee size of the steel mills show that a majority of the steel mills, 5 (38.46%) had an employee size of between 201 and 400 employees, followed by 4 (30.78%) with an employee size of above 400, 3 (23.08%) with an employee size of between 101 and 200 employees and 1 (7.69%) with an employee size of less than 100. This means that all the organizations studied had adequate manpower to enable easy adoption of the world manufacturing practices.

Table 4.5 Organization employee size

Employee Size	Frequency	Percentage
Under 100	1	7.69
101 to 200	3	23.08
201 to 400	5	38.46
Above 400	4	30.78
Total	13	100

Source: Research Data (2015)

4.2.5 Period steel mill has been inexistence

The results in Table 4.6 on period the steel mills have been inexistence, 1 (7.69%) had been existing for a period of less than 10 years, 2 (16.67%) had existed for between 10 and 20 years, 3 (23.08%) had existed for between 20 and 30 years and 7 (53.85%) had existed for a period of more than 30 years. This means that a majority of the steel mills could be presumed to have had adequate experience in their operation that enabled them to provide dependable information on the concept of world class operation practices and world class operations performance.

Table 4.6 Period steel mill has been inexistence

Period inexistence	Frequency	Percentage
Below 10 years	1	7.69
10 to 20 years	2	16.67
20 to 30 years	3	23.08
Above 30 years	7	53.85
Total	13	100

Source: Research Data (2015)

4.2.6 Organizations export status

From Table 4.7 on whether the organization exports its products or not, the study established that 12 (92.31%) of the respondents organizations were indeed exporting their products while 1 (7.69%) was not involved in the export aspect of the business which means that adoption of world class manufacturing practices was not an option to be ignored by the steel mills. This also followed that the information given by them was dependable.

Table 4.7 Organization export status

Export or not?	Frequency	Percentage
Yes	12	92.31
No	1	7.69
Total	13	100

Source: Research Data (2015)

4.2.7 Organizational reasons for exporting its products

The results in Table 4.8 on the ranking of the reasons why the organizations chose to participate in the exporting if its products revealed that the respondents rated search for greater profits as the main reason for exporting their products and rated production efficiency and management commitment to exporting as the least reasons for exporting its products.

Table 4.8 Ranking of reasons for exporting organizational products

Statement	Mean	Ranking
Increasing yearly sales	4.42	2
Increasing the growth of the firm	4.33	3
Having a larger market	4.17	4
Making greater profits	4.58	1
To take advantage of government incentives for exporting	4.00	7
Keeping pace with local competition	4.08	5
Overcoming competition in the local market	3.92	10
Competitive price advantage	4.00	7
Preventing dependence on local market for sales	4.08	5
Product uniqueness	4.00	7
Production efficiency	3.58	11
Management commitment to exporting	3.58	11

Source: Research Data (2015)

4.3. World Class Manufacturing practices in the Steel Mills

The study sought to establish the extent to which world class manufacturing practices had been adopted by the various Steel mill companies. The respondents were requested to indicate the extent of adoption of various elements of world class manufacturing practice within their organizations. The practices included Total Quality Management, Total Preventive Maintenance, Employee involvement, lean manufacturing and other techniques in practice. A 5-point Likert scale was used to rate the extent of adoption of the indicators whereby 1 point was accorded to ‘strongly disagree’, 2 points to ‘little agreement’, 3 points to ‘moderately agree’, 4 points to ‘greatly agree’ and 5 points to ‘strongly agree’.

Table 4.9 presents an analysis of the ranking of the world class manufacturing practices as indicated by the respondents.

Table 4.9: Ranking of adoption of world class manufacturing practices

World class manufacturing practices	Mean	Rank
Total Quality Management	3.89	1
Total Productive maintenance	3.69	2
Employee involvement	3.62	3
Lean manufacturing	3.34	5
Other techniques	3.50	4

Source: Research Data (2015)

The results show that the respondents rated as highest the adoption of Total quality management (3.89) as a world class manufacturing practice practiced most by the steel mill firms. This was followed by Total preventive maintenance (3.69), and then by employee involvement (3.62), followed by other techniques (3.50) and lastly Lean manufacturing (3.34) in decreasing order of adoption.

4.4 Operational performance

The study also sought to establish the extent to which a number of components of world class operational performance had been experienced as a result of adopting the world class operations practices in the steel mills. The respondents were requested to indicate the extent to which various indicators of world class operational performance had been experienced. The indicators included Quality, Delivery, Flexibility and cost. A 5-point Likert scale was used to rate the extent of the experience of the indicators whereby 1 point was accorded to 'no extent', 2 points to 'little extent', 3 points to 'moderate extent', 4 points to 'great extent' and 5 points to 'very great extent'.

Table 4.10 presents an analysis of the ranking of the indicators of operational performance as hypothesized by the respondents.

Table 4.10: Ranking of operational performance Indicators.

Indicator of operational performance	Mean	Rank
Quality	4.12	2
Delivery	4.22	1
Flexibility	3.94	4
Cost	4.05	3

Source: Research Data (2015)

The results show that the respondents rated Delivery (4.12) as the most improved indicator of world class operational performance as a result of adoption of the world class operations practices; followed by Quality (4.12); then Cost (4.05); and finally flexibility (3.94) in decreasing order of improvement.

The findings on the improvements experienced in world class operational performance as a result of adopting the world class manufacturing practices are in line with the observations of Burgess et al. (2013) who observed that adoption of world class manufacturing practices was a medium to eliminate wastes. Lummus et al. (2006) also noted that these practices eliminated those processes and activities that fail to add value as well as enhances the process steps that are valuable and crucial for production.

4.5 Benefits of implementing World Class Manufacturing practices

The study also sought to establish the benefits realized as a result of adopting world class manufacturing practices in the steel mills. The respondents were requested to indicate the extent to which various benefits could be attributed to the adoption of the practices. A 5-point Likert scale was used to rate the extent to which the benefits had been experienced whereby 1 point was accorded to ‘no extent’, 2 points to ‘little extent’, 3 points to ‘moderate extent’, 4 points to ‘great extent’ and 5 points to ‘very great extent’.

Table 4.11 presents an analysis of the ranking of the benefits of adopting and implementing world class manufacturing practices as hypothesized by the respondents.

The results show that the respondents rated more appealing products in the market (4.33) as the most experienced benefit as a result of adopting of world class manufacturing practices; followed by increased business performance visibility (4.17); then improved time to market and reduction in operation costs at (4.08); streamlined

outsourcing processes (4.00); improved job mastery (3.83); increased product quality (3.75) reduced lead time (3.67) and finally exceeded customer expectations (3.42) in decreasing order of benefits.

Table 4.11: Ranking of Benefits of adopting world class manufacturing practices.

Source: Research Data (2015)

Benefits	Mean	Rank
Reduced lead time	3.67	8
Cut on operation costs	4.08	3
Increased business performance visibility	4.17	2
Speed time-to-market	4.08	3
Exceeded customer expectations	3.42	9
Increased number of jobs mastered by employees	3.83	6
Improved product quality	3.75	7
Streamlined Outsourcing Processes	4.00	5
Most Appealing products in the global markets	4.33	1

Source: Research Data (2015)

4.6 Relationship between World class manufacturing practices and World Class Operation Performance in Steel Mills

To facilitate an inferential analysis of the relationship between world class manufacturing practices and world class operational performance of steel mills, the respondents were requested to indicate the extent to which world class manufacturing practices had contributed to world class operational performance. The mean responses for world class manufacturing practices and world class operational performance are summarized in table 4.12.

Table 4.12: Interaction of elements of world class manufacturing practices

Respondent	Y	X ₁	X ₂	X ₃	X ₄	X ₅
1	4.98	5.0	4.0	5.0	4.9	4.8
2	3.83	4.3	4.3	4.0	4.0	3.0
3	5.0	5.0	4.9	4.5	4.9	4.9
4	3.5	3.6	3.9	3.0	3.8	4.0
5	4.0	4.0	4.0	4.0	4.0	4.0
6	3.45	3.0	3.0	3.2	2.8	4.0
7	3.13	3.0	3.2	3.0	3.0	3.5
8	3.3	2.8	2.5	4.1	4.0	3.7
9	4.83	4.4	4.3	4.5	4.5	4.8
10	4.0	4.0	4.0	4.0	4.0	4.0
11	5.0	5.0	5.	5.0	5.0	5.0
12	3.45	3.0	3.0	2.3	4.0	4.0
13	3.83	3.9	4.2	4.0	4.0	4.0

Source: Research Data (2015)

Where Y is world class operational performance, X₁ is Total Quality management; X₂ is Total preventive maintenance; X₃ is Employee involvement; X₄ is Lean manufacturing and X₅ is other techniques

A regression model was applied to determine the relationship between world class manufacturing practices and world class operational performance of steel mills in Kenya. The linear regression model used took the following form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where: Y is the dependent variable which is world class operational performance; β_0 is the Y intercept; β_1 , β_2 , β_3 , β_4 , and β_5 are the coefficients of the predictor variable and X₁, X₂, X₃, X₄ and X₅ are the predictor variables

Where X₁ represents total quality management; X₂ represents total preventive maintenance, X₃ represents employee involvement; X₄ represents lean manufacturing; X₅ represents other techniques; ε is the error term.

World class operational performance being the dependent variable was regressed against the world class manufacturing practices being the independent variables yielding the results discussed in the following subsections.

4.6.1 World class manufacturing practices and world class operational performance

A regression analysis of the relationship between world class manufacturing practices and world class operational performance done yielded the results as is shown in Table 4.13.

Table 4.13: Regression Analysis Results for World class manufacturing practices and world class operational performance

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig. P-value	F	R	R ²	Psig from ANOVA	
	B	Std. Error	Beta							
1	B0	.587	.663		.885	.406	11.805	0.946	0.894	0.003
	X1	.691	.412	.865	1.675	.138				
	X2	-.133	.299	-.155	-.446	.669				
	X3	.076	.187	.096	.408	.695				
	X4	-.185	.245	-.191	-.757	.474				
	X5	.427	.191	.393	2.235	.061				

Source: Research Data (2015)

From Table 4.13, R (0.946) shows a strong positive relationship between world class manufacturing practices and world class operational performance. R² shows that 89.4% of the variation in world class operational performance is explained by the variation of the world class manufacturing practices of TQM, TPM, Employee involvement, Lean manufacturing and others.

In order to determine the significance of correlation coefficient r for operation performance, a test of significance was done as follows.

H0: $r = 0$ (The coefficient of correlation is not significant)

H1: $r \neq 0$ (The coefficient of correlation is significant)

It is a one tailed test at 5% level of significance with $df = n-2 = 13-2 = 11$. The decision rule would therefore be to reject H0: if computed t is less than 1.729

Computed $t = r \sqrt{n-2/1-r^2} = .0.946 \sqrt{13-2/1-.599} = 9.637$

Decision: since computed t (9.637) is greater than critical t (1.729), the null hypothesis is rejected implying that the coefficient of correlation between world class manufacturing operation practices and operational performance is significant.

The P values in the table represent ANOVA statistics used to present the regression model significance. Overall, the model is significant since the P value of 0.003 is less than the level of significance of 0.05.

From Table 4.13, the following regression model was established:

World class Operational performance

$$= 0.587 + 0.691X_1 - 1.33X_2 + 0.76X_3 - 1.85X_4 - 0.427X_5$$

P-Value is 0.003

Where X_1 represents TQM; X_2 represents TPM, X_3 represents Employee involvement; X_4 represents Lean manufacturing; X_5 represents other techniques.

The model shows that TQM (X_1) and employee involvement (X_3) are positively related to world class operational performance. TPM (X_2), Lean manufacturing (X_4), and Other techniques (X_5) are negatively related to world class operational performance as shown by their coefficient values. From this model, it can also be inferred that none of the components of world class manufacturing practices is significant since all their p-values are greater than the level of significance of 0.05. It would therefore not be appropriate to use this model to predict world class operational performance because all the individual parameters are not significant in explaining the performance. The findings on the significance of world class manufacturing practices is in line with the observations of Fatma (2014) who in her study finding established that if world class operations practices are consistently implemented then world class operational performance of the going concerns significantly improve.

4.7 Challenges experienced in adopting world class manufacturing practices

The study also sought to establish the challenges experienced in adopting world class manufacturing practices in steel milling firms in Kenya. The respondents were requested to indicate the extent to which the various challenges were being experienced within their facilities. A 5-point Likert scale was used to rate the extent of the challenges faced whereby 1 point was accorded to ‘no extent’, 2 points to ‘little extent’, 3 points to ‘moderate extent’, 4 points to ‘great extent’ and 5 points to ‘very great extent’.

Table 4.14: Ranking of challenges experienced in adoption of Lean operations practices.

Challenges	Mean	Rank
Costs challenge	3.42	9
Commitment	3.58	7
Training	3.75	5
Partial implementation	3.50	8
Overly optimistic expectations	3.33	10
Culture	4.17	2
Organization structure	4.33	1
Communication	4.09	3
Supportive measures	4.00	4
Others	3.75	5

Source: Research Data (2015)

The results show that the respondents rated organization structure challenge (4.33) as the major challenge experienced in the adoption of world class manufacturing practices by steel milling firms in Kenya. This was followed by culture (4.17) ; communication challenge rated at 4.09; absence of supportive measures rated at 4.00; others rated at 3.75; commitment challenge rated at 3.58; partial implementation rated at 3.50; cost challenge rated at 3.42 and finally overly optimistic expectations rated at 3.33 in decreasing order.

4.8 Discussion of Findings

Objective one of this research was to determine the relationship between world class manufacturing practices and operational performance of Steel Mills in Kenya some of the characteristics employed by world class firms, which were present in the sector, and determine whether they were deeply established or the results thereof might have been due to chance. World class organizations are found to encourage employees to be involved with what is happening in other departments, since these departments represent their internal customers (Schonberger, 1990). In committed organizations employees are even allocated to work in departments that don't touch on their specializations so as to know the expectations of their internal customer.

One characteristic of a world class company is to minimize waste in their areas of operations; because this ensures that all its resources go into creating value to its customers. These high performing firms normally implement packages and activities referred to as Just in time or lean management which ensure everyone within the firm is involved in waste minimization. The benefits of adopting world class manufacturing practices are to cut on operation costs, increased business performance visibility, improved product quality among others in the organizations, therefore the management of the firms ensures that all stakeholders involved are aware and trained on the importance of world class practices to achieve efficiency and operational performance in the organization.

The findings on the challenges experienced in the adoption of world class manufacturing practices is in line with the observations of Crowe (2012) who observed that insufficient justifications and lack of quantifiable evidence are the main obstacles to convince executives to adopt these practices. Bhatia et al., (2007) also observed that the effect of world class practices like lean manufacturing on individuals is something often cited as a downside of lean since it can be seen as exploitative and high pressure to shop-floor workers, and trade unions may view lean techniques as intensifying the work effort, increasing management control and undermining unions' independence.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary discussion on the effect of world class manufacturing practices on the world class operational performance of steel firms in Kenya. A conclusion discussing the general findings of the research is highlighted followed by recommendation based on the findings of the study. The limitations of the study and suggestions on areas of further research are discussed at the end of the chapter.

5.2 Summary of the Findings

This study focused on the various world class manufacturing practices that have been adopted by steel mill firms in Kenya this includes total quality management, total preventive maintenance, employee involvement, lean manufacturing and other techniques. The study established when the firms adopt the practices they give the firms competitive edge in the global market.

The study also found out that WCM is crucial to competition because the techniques and resources it combines can create new opportunities but when implementing the WCM techniques there may be different barriers such as partial implementation, overly optimistic expectations and implementation of WCM to conform to societal norms rather than for its instrumentality.

The study also found out that the company successfully managed to counter the challenge of staff resistance by creating awareness, involving staff in decision making and making the staff own the process. This arrayed all the fear of the unknown. Moreover, the employees were enlightened on the benefits of the company being elevated to world class status and so instead of resisting, they fully owned the implementation process.

5.3 Conclusion

The findings of this research are consistent with the research done by other scholars. The research sought to answer the following questions in order to meet the objective of the study; what is the extent to which WCM practices have been adopted in the steel manufacturing in Kenya; what have been the benefits of WCM practice application and use in the steel manufacturing in Kenya and what is the relationship between WCM practices adopted and operational performance. These questions were answered through the objectives of the study which were: To determine the extent to which WCM practices have been adopted in the steel manufacturing in Kenya; To determine the benefits of WCM practice application and use in the steel manufacturing in Kenya; and To examine the relationship between WCM practices adopted and operational performance.

The study concluded that indeed steel firms in Kenya were practicing world class manufacturing practices in the processes of product and service delivery to a moderate extend which had a positive effect on operational performance. There had been improved operational performance through enhancement of quality, flexibility, improved delivery, noticeable flexibility and reduced costs. This had generally led to reduced lead times, cut on operation costs, increased performance visibility, speed time to market, exceeded customer expectations, improved quality and streamlined organizational processes. According to Tourki (2010), many organizations have realized the need to adopt world class manufacturing practices in order to survive in the global competitive environment.

The study also concluded that in the course of adopting world class manufacturing practices, a number of challenges had been experienced. The challenges faced included resistance from the organization itself as an entity which tends to resist the changes that come with adoption of these practices. The resistance experienced was in terms of rigid structure, a people unwilling to adopt new ways of production and a culture too unfriendly to these practices. The inability by the steel milling firms to relate benefits that come with adoption of these practices and the investment that come with them hindered their full adoption. This coupled with the poor understanding of the concept had a significant challenge on the sustainability of the practices in the organizations.

The study further concluded that the adoption of world class manufacturing practices in steel milling firms in Kenya had significant impact on the operational performance. This relationship if properly harnessed could be used to ensure efficient and timely service delivery in the public health facilities.

5.4 Recommendations of the study

Based on the findings of the study it is recommended that Steel milling firms in Kenya adopt full implementation of world class manufacturing practices to experience to attain world class status. The management of these firms will have to set up clear policies on world class manufacturing practices and operations and communicate to the all the stakeholders on what it entails, what is expected, the potential benefits and challenges. The aim of this will be to embrace acceptance of this concept as best practice aimed at ensuring improved production and profitability.

Implementation of these practices in other sectors of the economy is highly recommended. This is because of the benefits that can be realized if fully implemented. The service sector like health sector can also benefit out of implementation of lean operations and management practices by improving or reducing the patient cycle time, reducing the cost of healthcare delivery, ensuring patient safety, assuring service quality, reducing patient wait time, improving patient care and simplifying patient billing process. All these aspects are prerequisites in ensuring a happy customer.

The adoption of these practices should be driven in a manner that it is strictly adhered to enjoy the true benefits of implementation. The management should drive this culture by setting up firm policies and communicating the intended benefits to the staff. There is a general lack of understanding of what world class status entails hence training on the same is highly recommended. This shall result in better understanding of the concept among the employees.

5.5 Limitations of the Study

The concept of world class manufacturing and world class operational performance and its adoption is really wide. The study did not cover all the practices considered to constitute lean such as Inventory management, Leadership among many others. Interesting findings would have been revealed had all the practices been considered here. Furthermore, the study was limited to 20 steel milling firms. The study was largely

constrained by the short time available. The interviewees also had tight schedules and could only manage limited time to provide the required data.

In addition there were a lot of interferences during the interview due to the nature of their work. The concept of world class manufacturing was also not well understood and this posed challenges in getting feedback and gathering information on its implementation. The dynamic nature of the product/service delivery management may change after a period of time and the views provided are limited to a given time period. These findings may not be applicable across time.

5.6 Suggestions for Further Research

The study hereby recommends that more research be done not only in the Kenya manufacturing sector but also in the service sector. This could also be extended to other areas within the wider service sector in Kenya that includes health sector, aviation industry, civil service among others..

Since this study lumped together several world class manufacturing practices, the study hereby recommends that future studies be done to analyse the relationship between each of the practices on the operational performance of both the manufacturing and service sector in Kenya. This study can also be replicated after five or more years to ascertain whether the situation would have changed.

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APPENDICES

Appendix 1: Questionnaire

PART A: General Information

1. Name of organization

2. What is your designation.....

3. Is the organization locally owned or is it a multinational? (Please Tick as appropriate).

Locally owned [] Multinational []

4. What category of steel mill firm? (Please Tick as appropriate).

Rolling Mill [] Galvanizing []

Other (Please specify).....

5. Indicate below the best representation of your company size in terms of employees.

Under 100 [] 101 – 200 []

201 – 400 [] Above 400 []

6. Indicate below how long your organization has been operational in terms of years.

Below 10 [] 10- 20 []

20-30 [] 30 -40 []

7. Does your organization export to other countries?

Yes [] No []

8. Do you think following are the reasons for your firm's involvement in exporting? Please indicate the level of importance your firm places on each of them. TICK the number that corresponds to your opinion using the key below.

1= Not important; 2 = somewhat important; 3 = Important;
4 = Very important; 5 = extremely important

REASONS	1	2	3	4	5
Increasing yearly sales					
Increasing the growth of the firm					
Having a larger market					
Making greater profits					
To take advantage of government incentives for exporting					
Keeping pace with local competition					
Overcoming competition in the local market					
Competitive price advantage					
Preventing dependence on local market for sales					
Product uniqueness					
Production efficiency					
Management commitment to exporting					

PART B: World class operations practice at the steel Mill plant.

9. Do you think the following are the factors that drive WCM practice in your organization?

On a scale of 1-5, where 1= strongly disagree and 5 = strongly agree, indicate the extent to which you agree or disagree.

FACTORS	1	2	3	4	5
Total quality management					
Employee involvement					
Employee training					
Quality assurance					
Process control					
Supplier reliability					
Supplier involvement					
Customer satisfaction					
Customer feedback					
Total Productive Maintenance					
Housekeeping, adoptions of 5s					
Cross training of operators					
Production and maintenance people together as a team					
Disciplined planning Process for maintenance tasks					
Good information tracking system					
Problem solving techniques(Brain storming ,cause-effect diagrams)					
Autonomous maintenance					
Bottle neck analysis					
Overall equipment effectiveness Methodology					
Employee Involvement	1	2	3	4	5

Employee training and education					
Employee involvement in decision making					
Lean Manufacturing					
Elimination of zero value activities					
Flexible information system					
Multifunctional teams					
Continuous improvements and zero defects					
Integration of suppliers					
JIT production and delivery					
Other Techniques					
Electronic data interchange					
Supply chain management					
Material requirement planning					
Material resource Planning					

PART C: World Class Operational Performance.

10. Please tick the extent to the following World Class Manufacturing practice have been enhanced as a result of adopting world class manufacturing practices

1=not at all; 2=to a less extent 3=to a moderate extent 4= to a large extent 5=to a very large extent

	1	2	3	4	5
<u>Quality</u>					
High Product performance					
High Product variability					
Conformance of final product to design specifications					
<u>Delivery</u>					
Short delivery time					
Delivery on due date (ship on time)					
On-time -delivery					
<u>Flexibility</u>					
Ability to introduce new products into production quickly					
Ability to adjust capacity rapidly within a short period					
Ability to make design changes after production has been done.					
<u>Cost</u>					
Labour productivity					
Product cost					
Reducing inventory					

PART D. Benefits of implementing world class manufacturing practices

11. On a scale of 1-5 rank the benefits your organization has achieved after adoption of world class manufacturing practices; 1 means to a little extend while 5 means to a very great extent.

1=not at all; 2=to a less extent 3=to a moderate extent 4= to a large extent 5=to a very large extent

	1	2	3	4	5
Reduced lead time					
Cut on operation costs					
Increased business performance visibility					
Speed time-to-market					
Exceeded customer expectations					
Increased number of jobs mastered by employees					
Improved product quality					
Streamlined Outsourcing Processes.					
Most Appealing products in the global markets					

PART E: Challenges of adopting WCM practices.

12. Indicate the extent to which you agree or disagree with challenges WCM implementation in your organization.

On a scale of 1-5, where 1= strongly disagree and 5 = strongly agree,

CHALLENGES	1	2	3	4	5
The management finds the practices costly and therefore need too much justification for any approvals and regular conflicts					
The management staff are committed to WCM implementation					
There is training programs on knowledge of WCM by employees					
There are measure put in place for monitoring implementation progress by implementation teams					

There is partial implementation of WCM techniques and lack of follow up of activities					
There is overly optimistic expectations by the management team and employees					
Implementation of WCM to conform to societal norms rather than for its instrumentality (the culture of employees resistance to change)					
The organization has a well-defined routine for attaining the objectives of implementation					
There is sufficient organizational communication among all stakeholders					
Organization has developed supportive measures among all departments for coordination with its human resource practices, management policies and technology					

1. What other factors do you consider inhibiting WCM practice adoption? (Please specify).....

.....
.....

Thank you for your time and co-operation

Appendix II: List of steel mill firms in Kenya

1. Apex Steel Ltd.
2. Athiriver Steel Plant Ltd
3. Blue Nile Steel Rolling Mills Ltd
4. Brollo Kenya Limited.
5. Corrugated Sheets Ltd
6. Devki Steel Mills Ltd
7. Doshi Enterprises
8. East African Foundry Works Ltd
9. Insteel Limited
10. Kaluworks Ltd
11. Kenya United Steel Company (2006) Ltd.
12. Mabati Rolling Mills Ltd.
13. Narcol Aluminum Rolling Mills Ltd.
14. Rolmil Kenya Limited.
15. Safal Mitek Ltd
16. Steel makers Ltd.
17. Standard Rolling Mills Ltd.
18. Techno Steel Industries Ltd
19. Tononoka Rolling Mills Ltd
20. Bhachu Industries Accurate Steel Mills Ltd

Source, 11th Edition Kenya Manufacturers & Exporters Directory 2015.