CHALLENGES FACING SHIFT OPERATIONS OPTIMIZATION IN MANUFACTURING FIRMS: A CASE STUDY OF CENTRAL GLASS INDUSTRIES LIMITED, NAIROBI COUNTY, KENYA

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A Research Project Submitted to the School of Management and Leadership in partial fulfillment of the requirement for the award of Executive Masters of Business Administration Degree, of the Management University of Africa

NOVEMBER, 2013
DECLARATION

This Research Project is my original work and has not been presented for a degree in any other University.

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Signature

Date

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Reg. No. EMBA/00032/3/2012

This Research Project has been submitted for examination with my approval as University Supervisor.

………………………………………
Signature

Date

Dr. Emanuel Awuor
DEDICATION

This work is dedicated to my lovely daughters Vision and Raymah whose daily prayers and encouragement gave me strength all the way to the completion of this project writing.
ACKNOWLEDGMENT

Many individuals played an important role in helping me to write, develop and refine this research and they all sincerely deserve special recognition. First is to my daughters Vision and Raymah (all of whom I am very proud of) from whom I took so much of their time in order to complete this project, deserve my deepest love and appreciation. Appreciation is also extended to my colleagues and staff of Central Glass Industries and in particular: Shadrack Karemu, Eric Nganda, Daniel K. Munyua, Christopher Muraya and Lukas Nyongesa, who truly stood by me to offer valuable assistance in making available the required data, technical advice and moral support that I so much needed to complete this research. In addition, I would like to really thank my supervisor Dr. Emmanuel Awuor for support, guidance, encouragement and patience throughout the conducting of this research project. May the almighty God greatly bless you all.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AMIS</td>
<td>Asset Management Information System</td>
</tr>
<tr>
<td>AOP</td>
<td>Annual Operating Plan</td>
</tr>
<tr>
<td>BPM</td>
<td>Best Practice Management</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
</tr>
<tr>
<td>COGS</td>
<td>Cost of Goods Sold</td>
</tr>
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<td>CGI</td>
<td>Central Glass Industries</td>
</tr>
<tr>
<td>CI</td>
<td>Continuous Improvement</td>
</tr>
<tr>
<td>DMAIC</td>
<td>Define, Measure, Analyze, Improve, Control</td>
</tr>
<tr>
<td>DWEBME</td>
<td>Diageo Way of Building Manufacturing Excellence</td>
</tr>
<tr>
<td>EMS</td>
<td>Environmental Management System</td>
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<tr>
<td>FY</td>
<td>Financial Year</td>
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<tr>
<td>GJ</td>
<td>Giga Joules</td>
</tr>
<tr>
<td>HFO</td>
<td>Heavy Furnace Oil</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>JIT</td>
<td>Just in time</td>
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<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
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<td>LPG</td>
<td>Liquid Petroleum Gas</td>
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<td>MDT</td>
<td>Multi-disciplinary team</td>
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<tr>
<td>NSV</td>
<td>Net Sales Value</td>
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<tr>
<td>PDCA</td>
<td>Plan Do Check Act</td>
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<tr>
<td>RCPS</td>
<td>Root Cause Problem Solving</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<td>---------</td>
<td>--------------------------------------------------</td>
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<tr>
<td>RFT</td>
<td>Right First Time</td>
</tr>
<tr>
<td>SBT</td>
<td>Shift Based Team</td>
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<tr>
<td>SHRM</td>
<td>Strategic Human Resource Management</td>
</tr>
<tr>
<td>SMED</td>
<td>Single Minute Exchange Dies</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Practice</td>
</tr>
<tr>
<td>SPC</td>
<td>Statistical Process Control</td>
</tr>
<tr>
<td>TPS</td>
<td>Toyota Production System</td>
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<tr>
<td>TQM</td>
<td>Total Quality Management</td>
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<tr>
<td>UDV</td>
<td>United Distillers Vintners</td>
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DEFINITION OF TERMS

**Pack to melt** - is measured as weight (tonnage) of glass output that has been packed for delivery to the customer divided by the total molten glass per given period of time.

**Productivity** - The output or results that come out from all the inputs in a process which include labour, raw material and machinery.

**Job change over** - This involves changing the machine parts and mould equipment in order to switch or change from the product being produced to a new product or SKU.
ABSTRACT

The aim of this research was to establish the challenges facing shift operations optimization in Central Glass Industries and make recommendations from the findings in order to achieve improved productivity and more competitiveness. The researcher had identified three key elements that work together to deliver Shift Operations Optimization. These were: Operating System, Management Infrastructure and Capability. The researcher used descriptive research to determine and report the findings of this study. Primary data was collected by use of questionnaires designed using a likert scale. The target population was 66 shop floor employees of Central Glass Industries. A sample size of 42 respondents was randomly selected by the researcher through a stratified random sampling procedure. The collected data was then coded by assigning specific numbers to facilitate analysis. Analysis was done using Statistical Package for Social Sciences (SPSS), then summarized and presented in form of tables and figures. Conclusion, discussions and recommendations were then given by the researcher as per the study objectives based on the research findings. From the findings, the study concluded that CGI is faced with challenges mainly around ownership, role modeling, accuracy in data capturing, consequent management and capability building. The study recommended that the Management of CGI considers the identified gaps in each of the variables, and focus on them to improve productivity. By so doing, CGI will be able to meet all its orders on time, in full with no errors. Satisfied customers will remain loyal to the business and make it more profitable and competitive.
CHAPTER ONE
INTRODUCTION

1.1 Background

Central Glass Industries (CGI) is a subsidiary of East African Breweries Ltd. (EABL) which is owned by Diageo, a public licensed company and number 1 premium drinks company in the world. CGI was started in 1987 as the only modern glass plant in the region at that time, with a monopoly of container glass production. Raw materials were readily available then and energy costs were fairly low. High defect levels and product reworks were looked at as being normal in a mass production, more so because after all glass is recyclable. Today, the situation is totally different owing to emergence of five key competitive forces which according to Porter (1980), in his book: "Competitive Strategy", shape every single industry and market. The five forces as listed by Porter include: how intense competition is within firms of the same industry in a given region/market, how easy it is for new companies to enter the industry and compete in the same market, how powerful suppliers are and how their stand can impact on a company’s profit margins and volumes, how much pressure the buyers or customers can place on a business, and the likelihood of customers switching to using alternative products or substitutes from a competitor, (Porter, 2004). Doing business today must therefore take a different approach by every manufacturing firm making a deliberate effort to continuously improve the quality of its products and services in order to remain competitive (Arora, 2007).

More investors have come into the market, all competing for the same resources such as manpower, raw materials and energy which have now become very scarce and costly (McQuigan, Moyer and Harris, 1999). Modern technology through research and development has introduced cheaper substitute products into the market such as plastic containers that can be used as packaging materials for certain products. Some of the competitors from other regions are able to sell glass containers to Kenya at a cheaper price because the energy cost in their respective regions (e.g. Egypt and Saudi Arabia) is very low hence are able to obtain it cheaply as compared to the energy prizes in Kenya. Streamlining and optimization of shift operations is one of the means
by which CGI can cut down on its production costs, gain a competitive edge and stay in business.

The melting of the raw material for glass making takes place in a furnace made of refractory bricks at a temperature ranging from 1220°C at the bottom of the furnace to 1580°C at the crown. The CGI plant operates for 24 hours on shift basis with three shifts operating for a total of 11 hours daytime and 13 hour during the night. The glass furnace at CGI is fired using three commercial energy sources which are: Heavy Fuel Oil (HFO), Liquid Petroleum Glass (LPG) and Electricity, all outsourced. Since the furnace temperatures are maintained for 24 hours throughout the year, the energy cost is very high especially in some instances where the molten glass is not being packed as good products for the market due to intervening factors. Any products found to be defective during inspection are isolated as ‘blocked’ ware and taken through resorting, a rework process, to recover the good and crush the defective. Womack and Jones (2003), described this reworking of products as a type of waste due to all the hidden costs the go along with it. Recycled glass is captured as overall process waste which negatively impacts on the cost of goods sold. The resorting exercise is carried out by contracted labour which is an additional cost.

CGI makes three different colors of glass yet the furnace is only one hence only one color can be made at a given time. At least 4 color changeovers are done in every financial period in order to meet the high customer demand. The colors made are flint glass, amber and green respectively. The runs are made on customer pull to demand basis where by orders are made by customers in advance and a production plan prepared by the Sales and Marketing Manager together with the Production Manager. The success of a production plan highly depend on continuous and efficient flow of material and information uninterrupted across all the functions in the organization all the way to the customer, (Ahuja, 1993). Change-over for instance, if not well planned and managed results in increased process waste and failure to meet the production plan.

CGI supplies its products to six bottling plants within the EABL group and to all other bottling companies in the region. These include Coca-Cola, Heineken, Pharmaceuticals, Nile breweries and food canning industries. The glass plant operates
in a highly competitive environment of a liberalized market where by its customers are able to source glass from other glass suppliers within the region and beyond. Main competitors in the same business include: Altajia in Dubai, Hindustan in India, Misri glass in Egypt, Saudi Arabia glass, and Kioo glass in Tanzania and Mili glass in Mombasa, Kenya. Both Egypt and Saudi Arabia have an advantage of cheap energy sources which makes their glass production very cost effective.

1.2 Problem Statement

Despite having a furnace capacity of 140 tones, only 76% of the molten glass on average is delivered as good products to the customer against an Annual Operating Plan (AOP) of 82%, as shown in figure 1.0 below, (source: CGI production tracker).

Fig. 1.0 Pack to melt against AOP trends for Financial Year (FY) 2011 to 2013

The business therefore ends up not meeting customer orders as required making the customers to source for the empty bottles from elsewhere. Escalating costs of energy demand that all the molten glass ends up as good products and delivered to the customers on time, in full and with no errors (OTIFNE) as planned if the business has to remain competitive.
The key energy sources for the glass furnace are electricity, Furnace oil (HFO) and LPG gas. The CGI furnace consumes 14,287,572 Kilo watts per hour (51,435 GJ), 5,464,416 liters (232,620 GJ) of Furnace oil (HFO) and 665,408 kilograms (33,404 GJ) of LPG gas to produce approximately 33,008 tons of product per annum (Source: Investment Grade Energy Audit Presentation; conducted by EMS Consultants Ltd (In Feb. 2012). This energy cost accounts for 45% of the total COGS, (Source: CGI balanced score card). Since the energy usage is already optimized, the business must find other ways of reducing the overall cost of production considering the hash economic times in which businesses operate and the growing pressure to reduce spending that comes with it. Shift operations optimization is one of the ways that CGI can achieve this objective, while maintaining high quality and delivery in a highly unionized working environment, (Imai, 1986).

The rising cost of raw materials and the customers’ increasing demanding for high quality glass containers at no extra charge has raised a necessity for CGI to up its game in streamlining and optimization of all its entire process in order to deliver customer excellence and stay ahead of competition. The East African Breweries which purchases over 80% of the glass from CGI for instance has been forced to source for alternative suppliers of the commodity by importing glass from Altajia in Dubai, Hindustan in India, Misri glass in Egypt, Kioo glass in Tanzania and outsourcing locally from Milli glass in Mombasa due to failure of CGI to meet the orders on time. Some of the competitors sell the glass at a cheaper price as compared to the price offered by CGI giving the competitors a competitive advantage. As a result customer orders have dropped from 30 million bottles in the 2012 financial year down to only 11 million for the 2013 financial year (Source: CGI Sales and Marketing).
1.3 General Research Objective

The general objective of this study was to investigate the challenges facing Shift Operations Optimization in Central Glass Industries Limited.

1.3.1 Specific Objectives

I. To determine the effect of Operating System on Shift Operations Optimization.

II. To investigate the effect of the Management Infrastructure on Shift Operations Optimization.

III. To find out how Capability influences Shift Operations Optimization.

1.4 Research Questions

I. What effect does the Operating System have on Shift Operations Optimization?

II. What is the effect of Management Infrastructure on Shift Operations Optimization?

III. How does capability influence Shift Operations Optimization?
1.5 Justification

The findings of this research will benefit the Management of Central Glass Industries by adding knowledge on challenges facing shift operations optimization and how to counter them. The study will be of help to operations directors and managers in the process of better understanding the link between business managers, shop floor and the overall business output. By implementing some of the recommendations that will be made in this study, CGI and many other organizations will benefit by improving their productivity through better utilization of the scarce resources available in the organization. The findings in this study will also in a way become an eye opener to Managers from other manufacturing firms on some of the bottlenecks in optimization of shift operations. By reviewing the findings, they may use them to step change operations in their respective manufacturing processes.

Other researchers may also build on the findings of this study to generate more knowledge that can contribute to the operational excellence in the wider field of manufacturing. Further suggestions from this study if well implemented will transform the mindsets and behaviours of the workers to display the right behaviours that will cause things to move in the right direction to deliver higher returns on investments for CGI as a business. By so doing CGI will be able to grow its market share by not only retaining its existing customers but also getting more new customers from the region and beyond for more business profitability.

1.6 Scope of the Study

The study is confined to investigating the challenges facing shift operations optimization at Central Glass Industries, in Nairobi County, Kenya. The study was conducted over a period of four months from July to October 2013. Target population was 66 employees of CGI who work on shift basis at the shop floor. A sample size of 42 employees, 64% of the target population, was randomly selected and used for collecting primary data by means of questionnaires.
1.7 Limitations of the Study

1.7.1 Lack of Cooperation
The researcher encountered difficulty in gathering some relevant information from respondents who were simply not co-operative due to some unexplained reasons best known to them. I overcame this by showing them a lot of respect and verbally appreciating the big role they play in the organization.

1.7.2 Language barriers
Gathering all relevant data did not come easy due to the fact that some respondents not being able to correctly interpret the English language used in the questionnaire owing to their low level of education. I overcame this huddle by taking time to explain to them exactly what the questions meant and what I was looking for from them, without influencing their decisions in answering the questionnaire.

1.7.3 Lose of Questionnaires by some respondents
Some of the questionnaires were misplacement of by respondents when all the shop floor workers were sent on a compulsory two weeks leave to allow repairs in the furnace which coincided with the study period for this research. I overcame this by using data from the questionnaires that were dully filled and returned.

1.7.4 Reluctance in answering the open ended questions
Most of the open-ended questions in the questionnaires were left blank by the respondents. This was partly overcome by the researcher taking time to further verbally explain to some of the respondents so as to extract from them relevant information that would be used to answer some of the research questions in this study.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Literature review examines the already existing studies that were carried out by other researchers identifying any information that is relevant to the research study. In this chapter, relevant literature that is related to and is consistent with the objectives of this study is reviewed. Existing and available information as written by different researchers on some of the best manufacturing strategies and ways of transforming manufacturing operations was explored and recorded in relation to the research questions in this study.

2.1.1 Definition and Importance of Operations Optimization

The term “operations” refers to all value adding activities or steps which a firm undertakes in order to deliver a finished product or service to a customer. It involves transforming resources such as raw material, or data inputs into desired goods and services in a manner with an effort to create and deliver value to the customer. Lysons and Farrington (2006) described operations from Porter’s Value Chain model as one of the primary activities in a supply chain. In his book “Competitive Advantage” Porter describes operations activities to constitute all value creating activities along a process line. These include machining of parts, assembling the parts or the actual production, packaging of finished products, equipment maintenance and carrying out of quality checks (Porter, 1985).

Porter’s Value Chain Framework has been used as a model to study or analyze specific activities through which firms can create value and competitive advantage. In a manufacturing set up, the framework aids with defining what value is from the customer’s perspective with an aim of ensuring products arrive at the customer’s end on time, packaging is fit for purpose, product quality is correct and the customer at the end of it all receives true value for their money. The operational strategy of a company is often part and parcel of a transformational initiative in an enterprise that is today being looked at not just in terms of process improvements and cost reduction but in a more broad and visionary manner for surfacing innovation opportunities that will not only transform their operations but also deliver long-term business performance improvements (Byrne, Lubowe, Blitz, 2007).
Optimization of operations concerns maximization of certain functions (for example machine speed) and minimizing of others (for example waste), subject to constraints arising from express laid down statutory requirements and company policies (FriarTuck, 2012). The big challenge is in determining the best combination of activity levels to fit within the limited resources available in a firm such as manpower, revenue and plant capacity without compromising on the product quality. The alternative chosen must be such that it is the most cost effective under the given constraints in a way to ensure the desired factors are maximized and the undesired ones minimized (http://investorguide.com). Heizer noted the following 10 decision areas of operation Management: Goods & services design; Quality Management; Process and capacity design, Location, Layout Design; Human Resources and Job Design; Supply Chain Management; Inventory, Material Requirements Planning and JIT; Intermediate and Short- term Scheduling; Maintenance (Heizer and Render, 2007).

2.2 Theoretical Literature Review

Exceptional performance, a prerequisite for every organization’s survival in the current competitive environment, is about attaining customer excellence and exceeding customer expectations. This was noted by Dale and Bunney (1999), in their book, Total Quality Management Blueprint, who also laid a lot of emphasis on the critical role Management and organizational support plays towards achievement of improved productivity effectively, efficiently and in the most economical manner. Purpose, Process and People were noted by Womack and Jonnes (2003), as key fundamental issues that should guide initiatives for business transformation and competitiveness, (Womack and Jones, 2003). McKinsey & Company researchers in the latest thinking recommended the Operating System, Management Infrastructure, Capability, Mindsets and Behaviors, as key elements when it comes to process waste reduction and value maximization to improve productivity in manufacturing, (http://www.mckinsey.com/manufacturing/operations practice /latest thinking). This study focused on the first three of the elements to help answer some of the research questions.
2.2.1 Operating System

An operating system as defined by Wild (2003), is a configuration of resources in form of inputs which are combined in an effort to convert them into outputs for the provision of goods and services which are required by the customer. When describing the nature of Operating System and Operations Management, Wild also called out: materials, machines and labor respectively, as key components of an operating system, (Wild, 2003). In their book, ‘in search for EXCELLENCE’ , Peters and Waterman (1982) suggested the Mckinsey’s 7-s Framework model that strongly points out the critical role that co-ordination plays towards the effectiveness of an organization. The 7-s in the model stand for: structure of the organization, strategy of the business, systems that operate within that organization, skill levels of the staff, style of leadership, staff involvement and shared core values (http://www.mckinsey.com ).

An effective operating system, according to Mckinsey & Company researchers, seeks to maximize customer value by optimizing processes and resources through five key elements which are: 1. waste elimination, 2. having an efficient end-to-end design, 3. focusing on value levers, 4. variability reduction and 5. Flexibility increase, (McKinsey & Company, 2007). Lean production system, a method of manufacturing first developed by Ohno Taiichi in the 1960s, noted that operating performance can be greatly improved by wedging a relentless attack on system inhibitors illustrated in Figure 2.1 below, (Womack, Jones and Roos, 1990).

![Figure 2.1: Lean Production System Inhibitors](http://www.mckinsey.com)

2.2.1.1 Waste Elimination

The term “waste” also known as “Muda” in Japanese refers specifically to any activities undertaken by human effort which consume or make use of resources but create no value to the customer, Womack and Jones (2003). They also observed that traditional manufacturing inhibits material flow and creates work in progress which is a type of waste. The first seven sources of waste as identified by the Toyota executive, Taiichi Ohno (1912-1990), include: doing more rework on the final product in an effort to rectify mistakes that should not have been there, producing excess goods that no one has asked for leading to high finished product stock levels, processing of products more than is necessary to the customer by adding excess value when it is not needed, high inventory, unnecessary motion, transportation, and any delays that result in the workers waiting either for a machine to be fixed or for part to be delivered, as illustrated in figure 2.2.

Figure 2.2: Types of Waste in a Production System


Failure to fully utilize employees’ intellectual contribution or potential was noted as an eighth source of waste by Womack and Jones, adding that waste elimination along the entire value streams creates processes that need less human effort, less capital, less time, less space and cheaper to produce, http://www.leanpresentations.com. When discussing how to eliminate total waste, Arora (2007) identified four additional sources of waste bringing to twelve, his total types of waste. The four included: waste
in untidiness, waste in communication and procedures, waste in bottlenecks (that the slowest stand in the process tend to pile up the work hence determining the output) and, wastage in timing, (Arora, 2007). A lean production aims at minimizing waste in terms of materials, time, space and people, (Armstrong, 2009). Having a capacity that is excess was described as wasteful and costly, where as having a capacity that is too little often than not ends up with customers who are dissatisfied and lost revenue (Stevenson, 2009).

2.2.1.2 Efficient End-to-End Design

Many hidden in-house quality costs result from in-built inefficiencies in a firm’s processes and systems, (Zairi, 1997). When the flow of products and services through the entire value stream is optimized, waste is eliminated and the customer receives perfect value for their money, Womack and Jones (2003). The layout needs to be properly analyzed and structured such that it contributes to the efficient movement of information; people and material with all blockers identified and eliminated, Heizer and Render (2008). Lean production’s main focus is on value addition by cutting down waste in terms of materials, time, space and people, (Armstrong, 2009). Figure 2.3 schematically illustrates the movement of information, material, people or finished products in the CGI production process.

Figure 2.3: Material Information Flow Analysis (MIFA)-CGI

Key:

- Manning levels at each work station.
An operations system design and its layout decisions have strategic implications for the organization and therefore must be rightly selected to suit the type of process and designed in a way to enhance smooth free flow of materials and information. While discussing process selection and facility layout, Stevenson noted that production costs, product quality, the firm’s productivity, customer satisfaction and competitive advantage are highly influenced by the process selection choices made. He further argued that process type determines the work organization and has huge implications not only on the entire organization but also on the organization’s supply chain. An efficient process design must be rapid, flexible enough to accommodate technological or design changes and a capacity to postpone customization until late in the production process (Heizer and Render, 2008).

Speeding up of the material flow from the supplier through the process line downstream and the flow of information from the shop floor all the way upstream to the top management leads to improved productivity providing a competitive advantage. This is so because customer requests are responded to on time and all non-value adding activities are eliminated along the process line, (Wild, 2004). While emphasizing the benefits of collaboration, Lysons and Farrington noted that design of the process and productivity are optimized through having a close connection and working together of cross-functional teams within an organization, its customers and suppliers (Lysons and Farrington, 2006). Cost reduction is complemented when operational efficiencies are improved and profitability growth achieved (Cudahy, 2003). Most hidden in-house quality costs in the manufacturing industry can have their roots traced back to production inefficiency, in which case, Zairi (1997) recommends the principle of accountability application that the function responsible for the failure brought to account for it, (Dale and Bunney, 1999).

Major elements of a firm’s operations and fundamental activities such as manufacturing, marketing and communications, can equally be subjected to continuous improvement through a structured approach called Business Process Management, that was described by Zairi (1997), as a structured approach to analyze and continuously improve all key processes and all other elements of a company’s operations. Zairi explained that BPM’s focus is on the main aspects of the business operations where there are big wins in terms of profitability and added customer
value. An end-to-end process management has overlapping responsibilities as demonstrated by Dale and Bunney’s End-to-End Process Management, figure 2.4.

![Diagram showing End-to-End Process Management](image)

**Figure 2.4: End-to-End Process Management**

**Source: Dale and Bunney, (1999)**

The term ‘BPM’ was first used to describe the Continuous Improvement process by authors such as DeToro and McCabe (1997), is quickly gaining its popularity over ‘Business Process Reengineering’ (BPR), which according to most researchers (for example: Deakin & Makgill, 1997, and, Caldwell, 1994), is said to have failed delivering on most of the results it had promised to deliver. Process Management, as noted by Macdonald (1995), has a lot in common with TQM. In order for it to be effective, BPM highly relies on the following key activities as outlined by Zairi (1997): That all major activities of the organization must be properly mapped and documented; Customer visibility and customer focus creation through horizontal linkages between key activities; Systems and clearly written down procedure are highly relied upon for guaranteed discipline, consistency and repeatability of quality performance; Measurement activities to assess the performance of each individual process, out of which realistic targets are set with enough stretch to deliver the desired output levels that can meet the overall business objectives according to plan; BPM has to be based on a relentless effort of continuous optimization of all the key activities
and functions through root cause problem-solving, high performance culture embedment across the site and reaping out extra benefits; and, that it has to be highly driven by best practice so as to remain competitive.

2.2.1.3 Focusing on Value Levers

Value chain optimization seeks to meet the following demands: To have the process designed is such a way as to achieve competitive advantage in terms of product uniqueness as perceived by the customer against that of competitors, quick and timely response capacity and cost effective; a process layout that is free from unnecessary steps that increase costs yet add no value to the customer; the process delivers perfect customer value from the customers’ perception; and, that the process will win more orders, respectively, (Stevenson, 2009).

Different kinds of tools are used to unfold the complexities of process design and redesign as a way of determining what adds value in the process and so must be retained and improved upon, or what does not add customer value in the process and must therefore be eliminated from the process. Five of the tools as described by Heizer and Render (2008), that can be used to analyses a system or process include: Flow diagrams, time-function mapping, value-stream mapping, process charts, and service blue printing. Value-stream mapping takes an expanded look at where value is added (not added) in the entire production process, including the supply chain. The whole idea is to start with the customer and understand the production process all the way back to the supplier. Value stream mapping takes into account not only the process but also the management decisions and information systems that support the process, (Heizer and Render, 2008).

For a production system to be sustainable, Stevenson (2009), noted that the processes must be designed and operated in such a way that: there is minimal waste and any ecologically incompatible byproducts are reduced to minimum acceptable levels, eliminated or recycled on site; any hazardous substances that could cause harm to human beings or pollution to environment are eliminated; energy is conserved; use of less material that is also appropriate for the desired end product; and, there is a safe working environment that is free from chemical, ergonomic, and physical hazards respectively, (Stevenson, 2009).
A proper layout as further explained by Stevenson, is key to facilitation of a smooth flow of information, material and services in the most efficient manner that is aimed at achieving benefits for the business that include: Enabling the firm to deliver improved quality products and services; Optimized usage of the scarce resources like manpower and raw materials; Avoidance of bottlenecks; Reduced material handling costs; Elimination of unnecessary movement of workers or material; Improved material flow through continuous flow processing; and, Provision of a safe work environment, (Stevenson, 2009).

2.2.1.4 Variability Reduction

Every process has its own challenges and inefficiencies that result in variability in their outputs. It is paramount for each firm to keep the variability within acceptable limits through constant measuring and monitoring, Evans, (2008). Non-random variations occurrence is an indication of some form of process instability that requires to be eliminated from the root cause; and enforcement of adherence to standard operating procedures in order to keep the inherent process variability in check to achieve a stable output, (Heizer and Render, 2006). One of the most effective ways of monitoring process output as recommended by Dale and Bunney (1999), "Statistical Process Control" is used to evaluate process output to decide if a process is "in control" or if more intervention is required to keep it on track.

A second variability in process output is called assignable variation, or nonrandom variation. In Deming’s terms, this is referred to as special variation. Unlike natural variation, the main source of assignable variation can usually be identified (assigned to a specific cause) and eliminated. In his book: Operations Management, Stevenson (2009) noted that process variation and demand variability and make it difficult for attaining a match between process output and process demand, hence interfering with the optimal functioning of the firm by disrupting both operations and supply chain process. Tool wear, equipment that needs adjustment, materials that do not meet specifications, human factors (carelessness, fatigue, noise and other distractions, failure to follow correct procedures and so on) and problem with measuring devices are typical sources of assignable variation, (Stevenson, 2009).
Four basic sources of variations as summarized by Stevenson include: (1) The number of different types of goods and services being offered - the more the variety of goods and services on offer, the greater the variation in production or service requirements; (2) Structural variation in demand - these variations which include trends and seasonal variations occurrence likelihood can be predicted in an effort to plan for the capacity required; (3). Random variations - Managers cannot influence or have any control over it because it is a natural variability that is present to some extent in all processes, as well as in demand for services and products; (4) Assignable variation - These variations are caused by incorrect inputs, wrong work methods, malfunctioning equipment, and so on. These types of variation can be reduced or eliminated by analysis and corrective action.

2.2.1.5 Flexibility Increase

Flexibility is one of the competitive strategies as stressed by Stevenson, (2009). He noted that decision makers choose flexibility systems for two reasons: Various forms or types of demand or there being a lot of uncertainty about demand. Flexible equipment are often more costly and not as efficient as the less flexible alternatives. In instances where products are in maturity stage, flexibility is not necessary because the products here only require few design changes, and there is a steady output. Ordinarily, this type of situation calls for specialized processing equipment with no need for flexibility. The implication is clear: Flexibility should be adopted with great care; its applications should be matched with situations in which a need for flexibility clearly exists.

Armstrong’s handbook of Management and Leadership describes flexible organizations as being capable of quickly adapting to new demands and operate fluidly. In a flexible firm, there is a structural flexibility in that the core permanent employees is supplemented by a peripheral group of short- or fixed term contracts or part-time employees, functional flexibility whereby employees can be redeployed quickly and smoothly between activities and tasks. It may require multi-skilling (workers who possess and can apply a number of skills for example mechanical and electrical engineering and numerical flexibility where numbers of employees can be quickly and easily increased or decreased in line with even short-term changes in the level of demand for labour (Armstrong, M., 2009). Armstrong credits this flexibility
concept to have originated from the work of Doeringer and Priore (1971), Loveridge and Mok (1979) and popularized by Atkinson (1984), who suggested that a flexible firm’s growth is highly supported by increasingly peripheral groups of workers clustered around a numerical stable core group that will conduct the organization’s key firm-specific activities. Charles Handy (1985) used the term ‘shamrock’ organization to describe a core periphery structure.

2.2.2 Management Infrastructure
A firm’s management has a sole responsibility to optimize its entire end-to-end process by driving the allocation and utilization of the scarce resources available in such a way as to achieve the organization’s ultimate goal, (Deming, 1986). The quality revolutionist strongly believed, as illustrated in figure 2.5 that productivity can only be improved by producing goods of high quality that will in turn make the organization to gain competitiveness.

![Deming Chain Reaction Diagram](source: Evans (2008))

The latest thinking from Mckinsey & Company research team noted five key management infrastructure elements that transform business performance, without which no change will occur. These include: Metrics and Incentive, Visual Workplace,
Performance Dialogues, Organizational Structure, and Continuous Improvement Infrastructure, respectively, (https://www.diageodwbme.com).

2.2.2.1 Metrics and Incentive

The performance of a firm or any of its single units can be gauged using quantifiable components of its key performance indicators, or metrics that have been set by the management to drive performance. In his Quality and Performance Excellence book, Evans (2008) noted that an organization’s dream of ever attaining world-class quality and competitiveness can only be achieved by it finding ways of doing things a little better and faster. For this to happen, there must be a mechanism in place to measure the current state in relation to the desired future state, (Womack and Jones, 1986). Apart from being able to measure its success and map the way forward, an organization can use the metrics to benchmark against the best performance internally within its own units and get learning from the best performing unit(s). The data collected may also be used to benchmark externally by comparing its performance on specific KPIs with the world’s best in the same industry or field of operation, (Heizer and Render, 2006).

An important aspect of managing or dealing with variation is to use metrics to describe it, (Stevenson, 2009). The mean and the standard deviation were noted by Stevenson as two widely used metrics in conjunction with variation explaining that the standard deviation qualifies variation around the mean. While describing the benchmarking process, Evans (2008) argued that the identified KPIs must have a direct link to customer’s needs and expectations.

Incentives are rewards added to items or offered to people aimed at increasing their influence in making certain choices or in behaving a certain way. Incentives offered to influence our behavior in a certain way are referred to as economic incentives. Positive economic incentives (for example awarding a good bonus to individual workers who have exceeded expectation in performance, or issuing stock options), are associated with things many people would like to get and therefore motivates people towards the desired behaviors. Negative economic incentive on the other hand are things people do not want to get (example, being penalized for coming late to work) thus motivates people to do the right thing and avoid the penalty. An incentive may
involve money, or other things like goods or services. (http://www.econedlink.org ). As emphasized in Armstrong’s Handbook of Leadership and Management, discretionary effort makes the difference between people working or doing a job for the sake of doing it and people doing a great job. Incentives are aimed at motivating people to give work their best and display the desired behaviors that will impact positively to the overall business performance, (Armstrong, 2009). Figure 2.6 shows the motivation process.

![Figure 2.6: The Process of Motivation](image)


Some of the ways that can be used as incentives for motivating people to do the right things, suggested by Armstrong (2009), include: Setting for them stretch and achievable goals; Putting in place a reward policy with clear criteria for recognizing good performance against set targets; Visibility of the business performance to the people and regular feedback on individual performance; Empowerment of people with the freedom to get on and succeed in their work under minimum supervision; Giving attractive financial incentives provided for by the organization’s reward system; Recognizing and acknowledging good performance; Enhance team expectations by providing timely team briefings that show the link between performance and reward; provision of effective leadership to the teams; Having in place a capability development plan to grow people’s knowledge and skills necessary to improve their performance and receive reward accordingly; and, Providing career advancement opportunities for the employees, respectively. Recognition of employees for good performance provides a visible means of promoting quality efforts and making
employees to feel valued and recognized, which stimulates them strive to perform even better, (Evans, R.J., 2008).

2.2.2.2 Visual Workplace

A visual workplace requires less supervision because it enables consistent communication and transparency of status in an organization, hence eliminating non-value-added activities by making problems, any abnormalities and standards visual, (Peters and Waterman (2003). As part of the key tools used in lean production, visual workplace controls are indicators, labels or signage for tools, parts and production activities that are strategically placed in the open to create visibility to all workers and anyone else visiting the site so that at a glance someone can be able to understand the status of the system, (Evans, R.J., 2008).

While discussing ‘Human Resource and Job design’ in their book, Principles of Operations Management, Heizer and Render (2008) noted that visual workplace aims at communicating information (example on : quality, accidents, service level, delivery performance, costs, attendance, walkways and danger signals), to stakeholders rapidly and accurately, using a variety of low-cost visual devices. Performance displays that are well designed and simplified graphs and charts are used by operations managers to provide real time performance updates, in place of the sophisticated print outs and paper work which are mostly tedious and difficult to understand.

2.2.2.3 Performance Dialogues

Performance dialogue is a management tool that drives corrective action and ensures accountability, (http://www.mckinsey.com ). Crosby (1979) argues that doing a job and getting it all right first time is always cheaper than having to rework. In Deming’s view, productivity and competitive position is improved by delivering quality through a reduction of statistical variations and in his 14 points for Management noted the need to break down barriers between departments and provide leadership by getting teams working together to proactively handle the challenges in production, (Evans and Lindsay, 2009). Managing for performance involves developing a culture within the entire organization in which everyone from top Management to shop floor strives for improved performance as a way of life, (Armstrong, 2009).
Characteristics of an organization in which a high-performance culture exists, were highlighted by Armstrong to include the following: clarity exists to all on what is expected of them, the scope of their job, deliverables and accountabilities; The people have the right skill levels necessary to enable them deliver on their goals and objectives; There is a system in place for recognizing and rewarding exemplary performance; People are motivated to carry on with their work and have the required competence to accomplish the task; Managers within the organization provide great leadership through coaching their subordinates, providing regular feedbacks to their teams, holding performance reviews at different levels and having a clear development plan; Continuous high performance in key roles is backed by a pool of talent that guarantees consistency in productivity improvement; and, The workers operate in an environment of trust and teamwork aimed at delivering customer excellence.

2.2.2.4 Organizational Structure

An organizational structure is defined by Armstrong (2009) as a framework, set up by the top management of an organization as a channel through which it gets its things done. Each level of structure has specified roles and responsibilities which include: units, functions, divisions, departments and formal work teams that are controlled, coordinated and integrated in such a way as to create a smooth flow of business activities, information and services to meet the organization’s objectives. The hierarchy of command in relation to the variety of activities in the different parts of the firm is usually presented in a chart with different layers depending on the complexity of the organization, (Armstrong, 2009).

When citing from Wasmuth’s "Organization and Planning" and Kimber’s "Quality Management Handbook", Evans (2008), stated eight factors that affect how work is organized in an organization context while discussing ‘Designing Organizations for Performance Excellence’. The eight include: Company Standard Operating Practices; The style of Management; Customer influence such as formal specifications and administrative controls from government agencies; Company size- it is a lot easier for large organizations to keep formal records than for smaller organization; Product line diversity and complexity- a process line that is meant for production of small quantizes of a sophisticated product such as medicine may be very different from a
mass production plant for standard goods; Line stability- a stable production line benefits from economies of scale than one which has frequent changeovers. The latter looses out on production numbers due to start up challenges experienced after job change; Financial stability- Manager’s efforts ought to fit within their departmental budgets for the firm; and, availability of personnel, (Evans, 2008).

2.2.2.5 Continuous Improvement Infrastructure

Globalization and trade liberalization has flattened the world making it a small village where people easily travel widely and get to discover products of same type made by different manufacturers. This was noted by Friedman (2006), in his book *The World is Flat*, in which he discussed and elaborated on what he termed ‘the ten forces the flatten’ the world. These ten forces, as noted by Friedman that include: the fall of the historical Berlin wall, outsourcing, in-sourcing, off-shoring, supply-chaining, open-sourcing, internet & digitalized revolution, workflow software, in-forming, and the steroids respectively, have resulted in a stiff competition among manufacturers each competing to capture a larger market share in the global village, Friedman (2006). Changing lifestyles and demographics has influenced entrepreneurs to come up with new products and services in an effort to satisfy the ever changing taste in demand, (Schumpeter, 1934; Singal, 2009).

Technological advance and knowledge has also led to an influx of imitations and counterfeit products into the market which necessitate manufacturers to upgrade in every way possible and to continuously improve the quality of their processes and products in order to stay ahead of the competition and gain a competitive edge, (Basu, 2004). While giving the history of quality movement in his book, *Implementing Quality*, Basu (2004) also noted that consumers’ expectations have been raised higher than ever before owing to a fact that people have encountered or experienced substitute products of more superior quality in the global market raising their expectations on the type and quality of products they would want to purchase. Arora (2007), in his book: *Total Quality Management*, outlined some key areas of focus as shown in figure 2.7 below, which he termed as “must” for any organization to gain improvement in its competitiveness.
Total Quality Management (TQM) is defined as the Management approach to an organization centered on quality that is based on all its members’ participation and aiming at a long-term success through customer satisfaction and benefits to all members of the organization and society, (ISO 8402 1995). Deming’s view is that the employees of a firm are fully responsible for the quality management and quality improvement of its products and services, (Deming, 1986). He defines quality in terms of: design (or the degree to which the product or service specifications satisfy the requirements of the customer), conformance (or the degree to which products and services that are availed to the customer conform to customer’s specifications) and quality of sales and services function, (Dale and Bunney, 1999). Three dimensions of quality as encompassed by TQM are shown in Figure 2.8 with particular emphasis on organizational quality, (Basu, 2004).
The following definitions of quality were given by various authors and researchers describing quality as: The degree to which it satisfies the customer’s requirements, (Wild, 2002); Fitness for purpose or use, (Juran, 1988); Getting everyone to do what he has agreed to do and do it right first time, (Crosby, 1992); Bringing a product or service to a customer as per customer requirements and specifications, ensuring it arrives to the customer on time, packaged in a manner that is fit for purpose, Womack and Jones (2003); and, quality being eight dimensional in terms of product: performance, features, reliability, conformance, durability, serviceability, aesthetics and quality as perceived by the customer, (Gravin, 1984). Quality of the organization, though not coming out clearly in the above models, was singled out to be a fundamental cornerstone in the quality of a holistic process, (Basu, 2004).

A key characteristic for the top management is the ability to provide leadership by clearly articulating the vision of an optimized supply chain downstream to all other team members and by so doing: energize the team to achieve goals by setting them up for success, formulate ways of doing things differently and introduce change, recognize talent among team members and nurture them through coaching and role modelling, embedding a culture of continuous learning and improvement while displaying high levels of personal integrity, (Lysons and Farrington, 2006). Brilliant leadership from the management team of an organization needs to underpin everything else they do, in order to truly embed a culture of continuous improvement.
Other tools and techniques used in C.I. developed from the Toyota model of lean manufacturing include: Toyota Production Maintenance, 5S-representing a Japanese word for ‘excellent house’, Kaizen; J.I.T. (Just-in-time), SMED (Single minute exchange dies), Judoka or zero quality control, Production work cells, Kanban and PokaYoke respectively, (Basu, 2004). Six Sigma, another methodology for C.I., has five phases abbreviated as DMAIC, (which stands for Define, Measure, Analyze, Improve, Control), consists of all the overall goals of TQM but with more emphasis on achieving focused results that are quantifiable, with approximately 3.4 defects per million opportunities (Gobb, 2003). The inherent resistance to change in the organization can be overcome using four steps, as defined by Eckes (2002), so as to effectively implement six sigma. The steps include: creating a change story to demonstrate the need for change and the long term benefits this would bring, a developed strategy having a mission statement defining the strategic vision and goals to be achieved, identifying and managing resistance and, changing the systems and structures of the organization by aligning them with the overall business strategic plan, (Cobb, 2003).

2.2.3 Capability

Womack et, al., noted in their book, The Machine That Changed the World, that for employees to prosper in an environment of change, they need to be exposed to a variety of challenges through which they can exercise the implicit knowledge which they have acquired over the years, failure to which they remain dormant and give up thinking they have arrived, (Womack, Jones and Roos, 2007). An underlying theme throughout Ishikawa, who introduced quality circles was cited in Dale (1993) as having stated that people at all levels of an organization should use simple problem solving techniques and work together to solve operational problems and by so doing removing barriers to improvement. Ishikawa was further quoted by Dr. Noguchi-executive director of JUSE (Japanese Union of Scientists and Engineers) to have claimed that 30 to 35% of an organization’s quality problems can be effectively solved through quality circles (Dale, 1993).
The management in a firm has a responsibility to give people a clear direction and skills to get the job done, (Cobb, 2003). While discussing the principles of lean thinking, Womack and Jones noted the following as key capability elements: Role modeling (‘walk the talk’ culture where by leaders consistently adopt and demonstrate the new behaviors); Communications cascaded at all levels of the organization aimed at bringing everyone on board and ensuring understanding and commitment by all stakeholders to doing things differently aimed at achieving extraordinary results for the business; Formal System and Structure to influence the desired change and the right behaviors to deliver results, (Womack and Jones, 2003).

Skill and Competence building approach, by developing company-wide capabilities that meet unique technical requirements of the organization was illustrated by Velaction C.I. Skills Pyramid as shown in Figure 2.9.

![Figure 2.9: Velaction Continuous Improvement Skills Pyramid](http://www.velaction.com)

Adaptability of both people and equipment and creating an environment where all employees get to fully connect and become involved with a culture of C.I. were noted by Imai (1986), as some of the key elements in Kaizen. In his practical guide on Tools
and Techniques (T&Ts) for C.I., Basu (2004) emphasized the need for equipping people within an organization with the right skills and knowledge on how to use appropriate tools and techniques accurately to achieve repeatable and reliable results for the business to reap their full benefits. Examples of tools for mastering include: Cause and Effect diagram, Pareto analysis, Relationship diagram, Control Chart, Histogram and Flow charts; while techniques for C.I. include: Statistical Process Control (SPC), Benchmarking, Quality function deployment, Failure mode and effects analysis, Design of experiments and self-assessment, Dale and McQuater, (1998).

Ishikawa (1979, 1985 and 1991) observed that barriers to improvement are removed whenever people working at all levels of an organization work together in one accord using simplified methods for problem solving, (Dale, 1993). The same sentiments were echoed by Deming (1986), in his 14 points to Management arguing that all departmental barriers must be removed and fear driven out so that everyone may be free to work for the organization without fear of victimization. The success of quality circles highly depends on the involvement and support of employees and unions, training of its members and leaders as well as each member’s individual characteristics, (Dale and Bunney, 1999). Among the Strategic human resource management (SHRM) key features is an emphasis on commitment and the exercise of initiative, with managers donning the role of “enabler”, “empowerer”, and “facilitator”, (Hendry and Pettigrew, 1986). People in an organization must be seen as a “strategic resource” for achieving “competitive advantage”, (Barker, 1999).

More efforts are being made around the globe in trying to identify factors related to team effectiveness. This is because an organizations most valued asset is the people who work for it. An energized team having the right people in the right place delivers exceptional outcome towards achievement of the overall business strategy. Quality management practitioners cited by Dale on quality circles, (e.g. Hutchins 1985, Mohr and Mohr 1983 and Robins, 1984), recommended the written wisdom on quality circles for effective teamwork and problem solving of most operational issues. Teams differ in form and structure, as summarized in Figure 2.10 below that was noted by Robins and Judge, (2005).
This model has typically included objective measures of the team productivity, managers’ ratings of the teams performance and aggregate measures of member satisfaction. To perform well as team members, individuals must be able to communicate openly and honestly, to confront differences and resolve conflicts. The task, team and individual need to overlap, as demonstrated by Adair (2004) in figure 2.11.
Figure 2.11: Team Task and Individual Needs


Adair argued that "task" has needs because pressure is built up to accomplish it to avoid frustration in the people involved if they are prevented from completing it (Adair, 2004). Adair further explained that the "team" maintenance needs are present because the creation, promotion and retention of group/organizational cohesiveness is essential on the ‘united we stand, divided we fall’ principle. The “individual” needs are the physical ones (salary) and the psychological ones of: Recognition, a sense of doing something worthwhile, status and the deeper need to give and to receive from other people in a working situation.

The Toyota Production System (TPS, 1988) and Lean manufacturing employ automation whenever an abnormality is cited. It may be described as "intelligent automation" or "automation with a human touch". This type of automation implements some supervisory functions rather than production functions. At Toyota this usually means that if an abnormal situation arises the machine stops and the worker will stop the production line. Autorotation prevents the production of defective products, eliminates overproduction and focuses attention on understanding the problem and ensuring that it never recurs. It is a quality control process that applies the following four principles: 1) Detect the abnormality, 2) Stop, 3) Fix or
correct the immediate condition, 4) Investigate the root cause and install a countermeasure, (Taiichi Ohno, 1990); (Womack and Jones, 2003).

Stop and fix culture as a way of working eliminates waste and improves productivity (LeanSigma® Manufacturing). Deming, a quality management practitioner noted that the defect prevention concept is more advantageous and cost effective than defect detection and associated rework (Deming, 1986). A lead time for a process includes the actual production time plus non-value-added time (Lysons and Farrington, 2006). The latter though may not be fully eliminated but it can be reduced to acceptable limits. In teams for which each member’s contribution is not clearly visible, there is a tendency for some individuals to decrease their effort, (Robins and Judge, 2005). Such people can hide inside a group which is referred to as social loafing which ends up being detrimental to the business.

2.3 Critique of Existing Literature and Summary

From the foregoing, the pushing for more output is very evident in most organizations with very little emphasis on stop and think to investigate the root causes of process non-random variability. No literature was found with investigations on challenges facing operations optimization in CGI which is the focus area for this study.

2.4 Research gap

Therefore there is the gap that this research will attempt to fill by clearly showing how these factors influence shift operations optimization in Central Glass Industries.
2.5 Conceptual Framework

Independent Variables

- Operating System
- Management Infrastructure
- Capability

Dependent Variable

- Shift Operations Optimization

**Figure 2.12: Conceptual Framework**

Independent (or change) variables are the cause supposed to be responsible for bringing about change in phenomenon whereas; the dependent variable is the outcome of the change(s) brought about by the independent variables, (Sekaran, 2003).
CHAPTER THREE
METHODOLOGY

3.1 Introduction
This chapter outlines various stages and faces that were followed in completing the study. It involves details in the collection, measuring and analysis of data. The specific sub sections included in this chapter are; research design, target population, data collection instruments, data collection procedures and finally, data analysis.

3.2 Research Design
The design of a research refers to the master plan that specifies the methods and procedures for collecting and analysing information that is relevant to the study, (Zikmund, 2003). This study adopted a descriptive research design in order to find answers to the research questions. According to Kothari (2004), descriptive research, also referred to as ‘ex-facto research’ in social science/business world, involves conducting of surveys and different kinds of fact-finding inquiries aimed at giving a clear description of affairs to reflect their true picture as exists at present, (Kothari, 2004). In a descriptive study, data is collected and used by the researcher to answer questions concerning the current state of the study subject (Mugenda and Mugenda, 2003).

The researcher employed qualitative methods to obtain the data relevant for answering the study questions. According to Kothari (2004), the phenomena in qualitative is related to kind or quality. By using a descriptive research, the researcher was able to determine a number of factors affecting shift operations optimization in CGI and enabled the researcher to achieve the study objectives by answering the research questions.

3.3 Target Population
The population of interest to this study was employees working on the shop floor at CGI. According the CGI headcount records sourced from its Human Resource Office, the shop floor full time shift workers are 66 in total, all employed on permanent basis. This comprises 18 middle level managers and 48 unionizable members of staff, presented as ‘other shop floor workers’. These include operators, craft, and quality inspectors as shown in tables 3.1 and 3.2 respectively.
Table 3.1 Target Population

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<thead>
<tr>
<th>Population category</th>
<th>Target population</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Shop floor Team leaders</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>Other shop floor workers</td>
<td>48</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>100</td>
</tr>
</tbody>
</table>

3.4 Sampling Instruments

The sampling technique used by the researcher was the stratified random sampling technique. As explained by Kothari (2004) and Mugenda & Mugenda (2003), studying an entire population is generally not possible and so most researchers will generally rely on sampling a section of the population on which to perform an experiment or make study observations. Mugenda and Mugenda also recommend a large a sample size as possible, for repeatability and reliability, especially where the target population is relatively small and the researcher has ample time with adequate resources. Same resuls would be guranteed should a repeat sample be taken for testing from the same population, (Mugenda and Mugenda, 2003). A sample size of 42 respondents was determined using a sample size calculator sourced from the Creative Research System, (http://www.surveysystem.com/sscalc.htm). This sample size represents 64% of the total population, at 95% confidence level and a confidence interval of 9.

Table 3.2 Sample Size

<table>
<thead>
<tr>
<th>Population category</th>
<th>Target population</th>
<th>Sample Size</th>
<th>Percentage</th>
</tr>
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<td>Shop floor Team leaders</td>
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<tr>
<td>Other shop floor workers</td>
<td>48</td>
<td>30</td>
<td>71</td>
</tr>
<tr>
<td>Total</td>
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<td>42</td>
<td>100</td>
</tr>
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</table>
3.5 Data Collection Methods and Procedures

Primary data was collected from the respondents by use of structured questionnaires (see appendix II). Mugenda and Mugenda (2003) noted that a questionnaire is a series of structured questions asked to individuals which if genuinely answered will assist the researcher to obtain statistically useful information on a given topic of research. The questionnaire, sourced from a Diageo website and modified to suit the objectives of this study was used for basic data collection, (http://www.diageodwbme.com). The questionnaire was developed with questions that are easy to understand and administer by the respondents. Both open-ended and close-ended questions were used in the questionnaire. The open ended questions gave the respondents an opportunity to give more depth to their response hence help to bring out some of the silent issues that would help in answering some of the study questions. The close-ended questions on the other hand would be easier to analyse owing to the fact that they are exhaustive and mutually inclusive, (Mugenda and Mugenda 2003).

3.5.1 Validity and Reliability

The validity of the data refers to how accurately or precisely the given information or data measures the desired study concept. Reliability is the consistency or repeatability of measures (Gatara, 2010). For guaranteed reliability and validity of the measures, a pilot study was administered to 6 respondents as shown in table 3.3, that were selected using judgemental sampling to pre-testing the questionnaire. The aim of pretesting the questionnaire was to ensure the questions were clear to all, carried the same meaning and was easy to use. The 6 respondents were made up of 2 shop floor team leaders and 4 other shop floor workers who comprised 2 operators, 1 craft and 1 quality inspector, respectively. The fact that the respondents worked in different areas of the process line at CGI facilitated a better review of the questions and the type of responses.

Table 3.3 Pilot Testing Sample Size

<table>
<thead>
<tr>
<th>Population category</th>
<th>Target population</th>
<th>Pilot Sample Size</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shop floor Team leaders</td>
<td>18</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>Other shop floor workers</td>
<td>48</td>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>6</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
3.5.1.1 Pilot Test Response Frequency on Operating System, Management Infrastructure and Capability effects on Shift Operations optimization.

Figure 3.1 Pilot Test Response Frequency Chart

KEY:
SD – Strongly disagree; D – Disagree; N – Neutral; A – Agree; SA- Strongly disagree

Respondents who were involved in the pilot testing did not form part of the target sample size in this research study. The responses, as shown in figure 3.1, were assessed to see if they satisfactorily met the study objectives. Adjustments were then made on the questionnaire before being administered to the respondents in the main study.

3.6 Data Processing and Analysis
All the data collected through the questionnaires was compiled and coded for easy classification in order to facilitate processing and analysis. A Statistical Package for Social Sciences (SPSS) software was used to analyse the data that was then presented in form of pie charts, figures and graphs. Tabulation was done by populating the tables with the required fields arranged in an orderly manner and counting the frequencies of responses to each specific question. All the collected data was summarised by use of descriptive statistics that were analysed qualitatively and used in describing the distribution of scores. Explanatory notes were used for presenting the results.
CHAPTER 4
RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction
This chapter presents analysis, findings and discussion of the study as outlined in the research methodology. The data collected has largely been summarised using descriptive statistics. The findings of the study are presented in the sections that cover the Profile of respondents; Operating System, Management Infrastructure and Capability that influence Shift Operations Optimization in Central Glass Industries. Primary data was gathered exclusively from the questionnaires that were designed in line with the objectives of the study.

4.2 Respondents Profile
The study realised a total of 38 complete questionnaires. This represents a respondents rate of 90% of the targeted number and 58% of the total population. The profile of the respondents is presented in the ensuing sections.

4.2.1 Response Rate

Table 4.1 Response Rate

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dully Filled</td>
<td>38</td>
<td>90</td>
</tr>
<tr>
<td>Not dully filled</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Table 4.1 shows the analysis of the response rate. As indicated above, the researcher intended to target a total of 42 respondents. Out of the 42 questionnaires issued, 38 were adequately answered and returned which constituted to 90%. However 4 questionaires were not filled and this was presented by 10%. Based on the above findings, the number of questionaires returned was considered definite to be used in the final analysis of the study.

4.2.2 Work Experience Analysis

Table 4.2 Work Experience Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 1 year</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>2 - 5 years</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>6 – 10 years</td>
<td>14</td>
<td>37</td>
</tr>
<tr>
<td>Above 10 years</td>
<td>15</td>
<td>39</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

According to table 4.2, the majority of the respondents were within work experience of 10 years or more bracket, presented as 39% of the respondents. This was closely followed by the 6-10 years work experience, presented as 37% of the respondents. Respondents with work experience of 2-5 years were found to be 16% and those who have worked for 1 year or less were 8%. It can be concluded that the majority of shop floor workers in this company have worked in the business for more than 10 years consisting of a well experienced workforce.
4.2.3 Gender Analysis

Table 4.3 Gender Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>32</td>
<td>84</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

According to table 4.3, the majority of the respondents were male, at 84%, while only 16% were female. It can be concluded that the majority of shop floor shift workers in the glass plant are male consisting of strong manpower that is necessary for most manual handling. This can be attributed to the nature and working conditions involved in the glass making process.

4.2.4 Academic Qualification Analysis

Table 4.4 Academic Qualifications

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certificate</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Diploma</td>
<td>15</td>
<td>39</td>
</tr>
<tr>
<td>Degree</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Other(s)</td>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

Total 38 100
The researcher also found out the academic qualifications of the employees that ranged from Certificate, Diploma, Degree and others as specified by the respondents. Table 4.4 revealed that Certificate holders constituted 21%, another 39% had diplomas, 24% were degree holders and, 16% presented as others, having gone up to secondary school level of education. It was also revealed that of the certificate holders were all from tertiary institutions and worked as operators under the union. Secondary school level employees were also found to be operators and in the union. Diploma and degree holders were found to be in lower and middle Management levels, as team leaders in the various disciplines at shop floor.

4.2.4.1 Academic Qualification vs. Work Experience Analysis

Table 4.5 Academic Qualification vs. Work Experience Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>&lt;1 yr.</th>
<th>2-5yrs.</th>
<th>6-10yrs.</th>
<th>&gt;10yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certificate</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Diploma</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Degree</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3</td>
<td>6</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

From the study, it was noted as shown in table 4.5 that respondents who have been in the business for less than 1 year were all diploma holders and those who have worked for the last 2-5 years were all diploma or degree holders. The study also revealed that majority of employees with secondary level of education have worked in the company for more than 10 years and that none of those falling in this bracket has been employed in the last 5 years. Certificate holders were equally found to have worked for the company for 6 years and above with none having been employed in the last 5 years. It can therefore be concluded that academic qualifications have become a key factor in CGI’s recruitment process as one of the business Human Resource Management strategies for supporting delivery of the overall business objective.
4.2.5 Present Function Analysis

Table 4.6 Present Function Analysis Findings

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>15</td>
<td>39</td>
</tr>
<tr>
<td>Asset Care</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>Team Leader</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Quality</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.6 revealed that majority of the respondents were Operators, presented by 39% followed by Asset Care team members, presented by 32%. Team leaders from various section formed 16% of the respondents while 13% were from Quality Assurance. It can therefore be concluded that majority of employees at shop floor work as operators in various sections or in asset care as craft and technicians respectively.

4.3 Effect of Operating System on Shift Operations Optimization

Figure 4.1 Effect of Operating System on Shift Operations Optimization Chart

**KEY:**
SD – Strongly disagree; D – Disagree; N – Neutral; A – Agree; SA- Strongly disagree
The extent to which respondents scored the effect of the Operating System on Shift Operations Optimization is shown in figure 4.6, 47% of the respondents affirmed that the operating system positively influences shift operations optimization; 9% found to be in the ‘strongly agreed’ and 38% in ‘agree’ brackets respectively. On the contrary, 30% of the respondents disagreed to the fact that the operating system is effective in supporting the shift performance optimization with, 25% of the respondents in the ‘disagree’ bracket and 5% in the ‘strongly disagree’ brackets respectively. Respondents who remained neutral in their decision were 23%. It can therefore be concluded that overall, the operating system was perceived to be effective in supporting shift operations optimization delivery. Scores on individual questions in each sub-category in the questionnaire were also analyzed by the researcher to extract relevant data that would help in answering some of the questions in this study.

4.3.2 Operational Efficiency effect on Shift Operations Optimization

Table 4.8 Operational Efficiency effect on Shift Operations Optimization

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Mean score</th>
<th>StDev</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of downtime are understood by all</td>
<td>3.8</td>
<td>0.90</td>
<td>76</td>
</tr>
<tr>
<td>Set targets are understood, owned and communicated</td>
<td>3.7</td>
<td>0.86</td>
<td>75</td>
</tr>
<tr>
<td>RCPS culture is embedded as a tool for problem solving</td>
<td>3.1</td>
<td>1.17</td>
<td>62</td>
</tr>
</tbody>
</table>

On a scale of 1:5 where:
1= Strongly disagree; 2= Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

From table 4.8, 76% of the respondents acknowledged of having understood the major sources of downtime, with a mean score of 3.8 ± 0.9. Through identifying downtime
sources and eliminating, the teams are able to stabilize the process and deliver more on throughput, (Womack, Jones and Roos, 1990).

75% of the respondents agreed to the fact that the management had set clear targets that were also owned and understood by the majority of the workers at shop floor. Mean score to this response was 3.6 with a standard deviation of ± 0.86. Scoring lowest in this sub category was the RCPS culture embedment for problem solving, which had a mean score of 3.1 ± 1.17 which translates to a wide range of scores between 1.93- 4.27. It can therefore be concluded that knowledge and application of tools and techniques in problem solving is one of the challenges at shop floor affecting operations optimization.

4.3.3 Labour Efficiency and its effect on Shift Operations Optimization

Table 4.9 Labour Efficiency effect on Shift Operations Optimization

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Mean score</th>
<th>StDev</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-value adding time is measured and current labor inefficiencies understood</td>
<td>2.5</td>
<td>0.98</td>
<td>50.0</td>
</tr>
<tr>
<td>Labor Efficiency and employee productivity targets are clearly defined</td>
<td>2.7</td>
<td>0.96</td>
<td>53.7</td>
</tr>
</tbody>
</table>

On a scale of 1:5 where:
1= Strongly disagree; 2= Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

As revealed by table 4.9, questions on labour efficiency scored low by the respondents. Measurement of value-adding time had a mean score of 2.5± 0.98, and clarity on labor efficiency/employee productivity targets got a mean score of 2.7±0.96. It can therefore be concluded that identification of sources of labour inefficiencies which more often than not result in output variability is another challenge coupled with lack of clear targets for measuring against and monitoring. Heizer and Render (2006) noted that all sources of variablitiy, caused by both internal
and external factors, must be identified by Managers and eliminated in order to achieve just-in-time (JIT) material movement.

4.3.4 Material/Process Waste effect on Shift Operations Optimization

Table 4.10 Material/Process Waste effect on Shift Operations Optimization

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Mean score</th>
<th>StDev</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process waste and the root causes are known</td>
<td>3.3</td>
<td>0.96</td>
<td>66.3</td>
</tr>
<tr>
<td>Waste targets are understood and owned</td>
<td>3.0</td>
<td>0.93</td>
<td>60.0</td>
</tr>
<tr>
<td>Waste levels are visible to all and used in driving performance improvements</td>
<td>3.5</td>
<td>1.01</td>
<td>69.5</td>
</tr>
</tbody>
</table>

On a scale of 1:5 where:
1= Strongly disagree; 2= Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

The extent to which respondents perceived material/process waste in relation to shift operations optimization was determined as shown in table 4.10 above. On average, respondents tended to agree that process waste and the root causes are known depicted by a mean of 3.3 ± 0.96, that ranges between 2.30 to 4.26. The researcher also noted that respondents were mostly neutral when scoring their understanding on waste targets and ownership, that had a mean score of 3.0 ± 0.93, ranging from 2.07 to 3.93 which is fairly low. Visibility on waste levels and its use in driving performance improvements was scored by the respondents with a mean score of 3.5 ± 1.01, that ranged from a score of 2.49 to 4.51. It can therefore be concluded that there is an opportunity around waste targets awareness and ownership at shop floor.
4.3.5 Asset Care effect on Shift Operations Optimization

Table 4.11 Asset Care effect on Shift Operations Optimization

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Mean score</th>
<th>StDev</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset care strategy delivery</td>
<td>3.4</td>
<td>1.06</td>
<td>68.4</td>
</tr>
<tr>
<td>Asset Care KPIs are aligned to the Asset Management Information Service (AMIS) requirements</td>
<td>3.2</td>
<td>1.02</td>
<td>64.7</td>
</tr>
<tr>
<td>Teamwork exists between the engineering team and other sections at shop floor</td>
<td>3.2</td>
<td>1.14</td>
<td>63.7</td>
</tr>
</tbody>
</table>

On a scale of 1:5 where:
1= Strongly disagree; 2= Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

From table 4.11, the respondents perception of Asset Care contribution towards operations optimization had a mean score of 3.4 ± 1.06, ranging between 2.34 and 4.46, respectively. The Asset Care KPIs alignment to the global AMIS requirements had a mean score of 3.2 ± 1.02, ranging from 2.18 to 4.22. Close to this was the score on teamwork between asset care and the other teams which had a mean score of 3.2 ± 1.14, ranging from 2.06 to 4.34. The lower range in each sub-category points to an opportunity in asset care that can be turned around to deliver operational excellence.
4.4 Effect of Management Infrastructure on Shift Operations Optimization

Findings from Table 4.12 and figure 4.7 revealed that a total of 50% of the respondents expressed their satisfaction in the existing Management Infrastructure with regard to Shift Operations Optimization. Of this, 36% were in the ‘agree’ bracket and 14% in the ‘strongly agree’ brackets respectively. The findings also showed that 24% were dissatisfied with the Management Infrastructure out of which 20% were found to be in the ‘disagree’ bracket and 4% in the ‘strongly disagree’ bracket. 25% of the respondents were found to be neutral in their scoring. The researcher therefore chose to investigate further by interrogating scores on specific questions in the questionnaire to extract some more information that would be useful in making a conclusion on the impact Management Infrastructure has on shift operations optimization as perceived by the respondents.
Table 4.13 Management Infrastructure Effect on Shift Operations Optimization

<table>
<thead>
<tr>
<th>Category</th>
<th>Mean score</th>
<th>StDev</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance boards location and use</td>
<td>4.1</td>
<td>0.75</td>
<td>82</td>
</tr>
<tr>
<td>KPIs understanding and application</td>
<td>3.6</td>
<td>0.83</td>
<td>71</td>
</tr>
<tr>
<td>Targets visibility and ownership</td>
<td>3.9</td>
<td>0.81</td>
<td>77</td>
</tr>
<tr>
<td>Performance dialogues and root cause analysis</td>
<td>3.5</td>
<td>0.98</td>
<td>70</td>
</tr>
<tr>
<td>Shift based team (SBT) meetings frequency</td>
<td>4.0</td>
<td>0.88</td>
<td>80</td>
</tr>
<tr>
<td>Agenda for meetings is always set in advance having KPIs and targets as the foundation.</td>
<td>3.2</td>
<td>1.14</td>
<td>64</td>
</tr>
<tr>
<td>Standardized procedures for problem solving</td>
<td>3.6</td>
<td>0.76</td>
<td>72</td>
</tr>
<tr>
<td>RCPS actions ownership and traction</td>
<td>3.0</td>
<td>1.03</td>
<td>60</td>
</tr>
<tr>
<td>Level of engagement in RCPS sessions</td>
<td>3.0</td>
<td>1.01</td>
<td>60</td>
</tr>
<tr>
<td>Freedom to succeed by team leaders in meetings</td>
<td>4.2</td>
<td>0.74</td>
<td>84</td>
</tr>
<tr>
<td>Planning and prioritization</td>
<td>3.1</td>
<td>1.05</td>
<td>62</td>
</tr>
<tr>
<td>Clarity on roles and responsibilities</td>
<td>3.5</td>
<td>0.83</td>
<td>70</td>
</tr>
<tr>
<td>Leaders spend significant time coaching and holding people accountable for any under performance</td>
<td>2.1</td>
<td>0.85</td>
<td>42</td>
</tr>
<tr>
<td>A clear training plan has been established to build employees skills</td>
<td>2.2</td>
<td>0.82</td>
<td>45</td>
</tr>
</tbody>
</table>

On a scale of 1:5:
1= Strongly disagree; 2= Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

For the purpose of answering the study questions, the researcher focused on the questions in table 4.13 that were found to have a standard deviation that is greater than 1 and those found to be having a comparatively low mean score. Consequently, areas identified as opportunities for Continuous Improvement by the researcher include: Meetings agenda effectiveness which had a mean score of 3.2 with a standard deviation of 1.14, which according to respondents ranged from 2.06 to 4.34; Ownership and tracking of RCPS actions with a mean score of $3.0 \pm 1.03$, ranging
from 1.97 to 4.07; Level of engagement during the RCPS sessions that had a mean score of 3.0 ± 1.01 ranging between a score of 1.99 to 4.01; Planning and prioritization, which had a mean score of 3.1 ± 1.05 ranging from 2.05 to 4.15; Coaching by leaders and holding people to account, with a mean score of 2.1 ± 0.85 ranging from 1.25 to 2.95; and, Employees skills development plan that had a mean score of 2.2 ± 0.82 ranging from 1.38 to 3.02, respectively.

The researcher also noted that, coaching and holding people to account, had the lowest score of 42% followed closely by employee training plan at 45% respectively as perceived by the respondents. It can therefore be concluded that problem solving, planning and prioritization, as well as people training and development pause a big challenge which if well addressed will have a positive impact on the optimization shift of operations. A call for the need to institute leadership at shop floor was made by famous Quality Management practitioner, Deming (1986), who urged that supervision only becomes meaningful when it translates into helping people, machines and gadgets to do a better job.

### 4.5 Capability Influence on Shift Operations Optimization

**Figure 4.3 Influence of Capability on Shift Operations Optimization Chart**

**KEY:**
- **SD** – Strongly disagree
- **D** – Disagree
- **N** – Neutral
- **A** – Agree
- **SA** – Strongly disagree

From figure 4.8, the study revealed that more than half of the respondents acknowledged the positive effect that capability has on operations. 42% of the scores
were within the ‘agree’ bracket and 10% in the ‘strongly agree’ bracket. However, 19% of the respondents disagreed and another 4% strongly disagreed to the fact that the current capability has a positive influence on optimization of shift operations. The researcher also noted that a quarter of the respondents, presented by 25%, were within the neutral bracket. A further analysis on the scores of specific questions was also done in an effort to extract more information that would facilitate answering some of the questions in this study.

Table 4.14 Capability influence on Shift Operations Optimization

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Mean score</th>
<th>StDev</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence of challenge to improve with set targets</td>
<td>3.6</td>
<td>0.83</td>
<td>71.1</td>
</tr>
<tr>
<td>Focused on delivering great results</td>
<td>3.0</td>
<td>1.03</td>
<td>59.5</td>
</tr>
<tr>
<td>Role modeling by the leadership team and their visibility at shop floor</td>
<td>2.4</td>
<td>0.91</td>
<td>47.4</td>
</tr>
<tr>
<td>Collaboration among teams across the shop floor</td>
<td>3.1</td>
<td>1.01</td>
<td>62.1</td>
</tr>
<tr>
<td>Change agents in the organization to drive continuous improvement</td>
<td>3.5</td>
<td>0.86</td>
<td>69.5</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>3.4</td>
<td>0.98</td>
<td>68.9</td>
</tr>
<tr>
<td>Clarity on business objective and how own role contributes to the whole</td>
<td>4.2</td>
<td>0.72</td>
<td>83.2</td>
</tr>
<tr>
<td>Ability to work over and above the call of duty for the success of the business</td>
<td>3.6</td>
<td>1.01</td>
<td>71.1</td>
</tr>
</tbody>
</table>

On a scale of 1:5:
1= Strongly disagree; 2= Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

From table 4.14 above, the respondents agreed to most of the questions on capability. A total of 5 out of the 8 questions answered by the respondents had each a mean score
of 3.4 and above. The researcher also found out that role modelling by the site leadership team was scored the lowest with a mean score of 2.4 and a standard deviation of 0.91 as perceived by the respondents. The issues around focusing on great performance by respective teams and, collaboration among teams, were both found to have mean scores of $3.0 \pm 1.03$ and $3.1 \pm 1.01$ respectively. It can therefore be concluded that a leadership gap exists between management and shop floor. The varying perceptions on team work as discovered by the researcher also point to an existing opportunity of building strong and effective teams through enhanced teamwork.

### 4.6 Suggestions

The researcher also sought suggestions from respondents through the questionnaire on what else in their view needs to be done differently by CGI in order to improve on its performance output. A total of 76 suggestions were made by the respondents aimed at improving productivity at CGI. The suggestions were then grouped in various categories for ease of analysis and as presented in table 4.15.

**Table 4.15 Suggestions by respondents on need for change**

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Man</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Material</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Method</td>
<td>36</td>
<td>47</td>
</tr>
<tr>
<td>Measurement</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Suggestions for improving on the method of doing things were found to be the highest in number presented by 47%, followed by people issues at 42% respectively. Others were suggestions on machines at 7%, call out for improvement on measurement of parameters at 3% and material handling at 1%, respectively.
Machines issues pointed out were on the need to avail spares for the maintenance of various equipment and use of correct mould equipment for glass forming. The key callouts on the man category mainly pointed out the need to resolve people issues instead of transferring problematic individuals to other shifts through reshuffles; up-down timely communication to flow freely at all levels; Incentives, reward and recognition for good performance to motivate the teams; and the need to hold people to account for their actions.

On methods, respondents called out the need to improve on the induction process for new employees and training them well before assigning them full responsibility on the job, defects correction to be done at source by getting it right first time instead of relying on quality inspection, communication on performance to be done in all the meetings and, a need to create more awareness of waste across the shop floor. This clearly shows that majority of respondents believe in change towards lean manufacturing as the way CGI must go to optimize its operations in order to become more profitable and remain competitive.
CHAPTER FIVE
SUMMARY CONCLUSION AND RECOMMENDATION

5.1 Introduction
This chapter contains summary of findings from the study, conclusion and recommendations of the study based on the study objectives. Suggestions for further research are also provided in this chapter. The study objectives was to investigate the challenges facing Shift Operations Optimization in Central Glass Industries.

5.2 Summary
Labour, a factor of production and a key component of an operating system needs to be streamlined in a way as to support delivery of a process layout that is free from non-value adding steps, Stevenons (2009). Challenges around labour efficiency optimization as revealed by the data analysis can be overcome by measuring employee productivity and effectiveness with clearly set targets that would drive process improvements tracked in the BPM as called out by Zairi (1997). Any under-performing employees if left unnoticed tend to discourage and kill the morale of high performers within a given team. The latter on the other hand if noticed, recognised and appreciated become motivated enough to deliver exemplary performance beyond their call of duty for the business to succeed.

The discipline of applying root cause problem solving tools and techniques consistently if fully embedded at shop floor will provide quick wins in terms of profitability and customer value. Interruptions that lead to variability in the process such as frequent machine stops will be eliminated and the firefighting replaced by a well planned preventive maintenance schedule that guarantees improved plant availability and overall equipment effectiveness. An appropriate training plan based on identified skill gaps is also key for equipping people within an organization with the right skills and knowledge on how to use appropriate tools and techniques accurately to achieve repeatable and reliable results for the business to reap their full benefits.

Use of Process Confirmation by managers as a tool for routinely checking in their respective areas to ensure that all processes are being complied with and all
improvements are being sustained. The PDCA Cycle, also known as the Deming Cycle, enables a continuous flow of communication top down and vice versa by ensuring that Managers communicate with, and coach, the employees in the correct processes and behaviors. When this happens, standards are supported and reinforced alongside sustainance of the desired change and process improvements.

5.3 Conclusion
The researchers found out that there are unlimited benefits that accrue to firms that embrace lean manufacturing through waste elimination and streamlining end-to-end processes to deliver value to the customer. Such benefits include: safe and better working environment, improved productivity due to continuous improvement driven by timely review and tracking of performance, satisfied customers, an expanded customer base and remaining competitiveness.

Moreover, the researcher has also found out that there are challenges facing the whole process of Shift Operations Optimization mainly touching on: lack of clarity on sources of labour inefficiencies with no set targets for measuring the same, presence and support of the leadership team not being felt at shop floor, no consequence management with people not being held accountable for under performance and, training and development gap.

However, as a result of this research, identified gaps which if closed shall transform the business to become the most celebrated business in the region and get back to its prime position in the market. Process waste shall be eliminated and resources such as labour, raw material and energy, which are very scarce, better utilized making the business to achieve all its objectives as planned.
5.4 Recommendations

The research has identified the need to further identify and eliminate all non-value adding activities in the entire process and focus only on that which add customer value. This would facilitate a smooth flow of material and information in such a way as to deliver customer excellence. The researcher also recommends the following in order for the organization to reap maximum benefits from its business operations:

There is need to build the competency levels of each employee at shop floor as well as the entire business such that they can freely apply the tools and techniques given to them comfortably and effectively. For them to be good players, they must be coached and trained well with much practice if they have to deliver exemplary performance. The line Managers need to develop a standard tool for assessing skill gaps of the respective job holders, then plan and upskill the workers.

The researcher also recommends that a study be further conducted on the different changeover frequency and timings, and their impact on business performance against plan. Measuring and documenting these will reveal opportunities for continuous improvement in terms of better planning and brilliant execution of strategy. Failure of adherence to the production plan as scheduled owing to the customers making abrupt changes at their end destabilises the process introducing variability that would otherwise be avoided through proper planning and mutual agreement with the stakeholders.

An investigation should also be carried out on defects to find out if there are any defect types that are prevalent in some specific SKU during production. The top three in each product can then be investigated for root causes and recommendations made which if documented and all the identified gaps closed would form a basis for reference the next time such a product is put on the line. This would help to reduce the time spent on fine tuning after changeovers and improve productivity. Benchmarking with other industry players who manufacture the same products would also be of benefit the business in terms of best practice sharing for continuous improvement. By so doing, CGI will become more profitable and maintain its competitiveness in the harsh economic reality in which it operates.
REFERENCES


Enduring ideas the 7-s framework. Retrieved on 18th July 2013 from http://www.mckinsey.com/insights/strategy/Enduring_ideas_the7-s_framework/


Appendix 1: Introductory Note

Hello colleague, my name is Priscilla Sifuma currently supporting the Perfect Plant program in CGI. I am carrying out a study on challenges facing shift operations optimization in manufacturing firms as a partial fulfillment of an Executive MBA degree which I am undertaking at the Management University of Africa (MUA). This study will interview samples representing most of the shop floor workers in CGI supply and you have been selected at random as part of a representative sample of the shift employees within the business. I would like to ask your views on a number of different subjects. Your input will be treated strictly confidential but it will contribute to a better understanding of the challenges faced in manufacturing on shift operations optimization.
Appendix 2: Shop floor Survey Questionnaire

1. For how long have you worked for CGI?
   Please tick as appropriate: (< 1 year; 2-5 years; 6-10 years; > 10 years)

2. Gender: (Please tick as appropriate) Male / Female

3. Level of education: primary level, secondary, certificate, diploma, degree,
   Other (please specify) …………………………….

4. Current role in the business: operator / asset care/ team leader / quality

<table>
<thead>
<tr>
<th>Overall Score</th>
<th>SA</th>
<th>A</th>
<th>N</th>
<th>D</th>
<th>SD</th>
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<tbody>
<tr>
<td>OPERATING SYSTEM</td>
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<tr>
<td>Sources of downtime are well known by my team members.</td>
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<td>Set targets are clearly communicated, are understood and owned by majority of my team members.</td>
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<td>Root Cause Problem Solving sessions are held by my team on losses with rigorous tracking of actions emanating from the RCPS.</td>
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<tr>
<td>Non-value adding time is measured and there is a deep understanding of current labor inefficiencies.</td>
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<td>Overall People Effectiveness (OPE) and Employee Productivity stretch targets have been set, owned and understood by majority of my team members.</td>
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<td>There is a deep understanding of loss waste and the root causes.</td>
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<td>Waste targets are owned and understood by majority of my team members.</td>
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<td>Waste levels are communicated to all and used to drive performance improvements.</td>
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<td>An articulated asset care strategy is in place with deep understanding of the current operational issues and asset care benefits to the business.</td>
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<td>Global Asset Care KPIs are used with clear targets that are aligned to the Asset Management Information Service (AMIS) requirements.</td>
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<td>Engineering and Operations are one team.</td>
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<td>Briefly comment on what else needs to be done differently in our process in order to reduce waste and improve the pack to melt.</td>
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<td>MANAGEMENT INFRASTRUCTURE</td>
<td>SA</td>
<td>A</td>
<td>N</td>
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<td>Performance boards are centrally located in each production area, updated hourly and issues clearly identified</td>
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<td>KPIs are consistently calculated accurately and understood by all operators</td>
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<td>Targets are clearly visible on the performance boards, team members own and challenge the targets</td>
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<td>Performance boards are used by each shift to drive change through performance dialogues and RCPS when the KPIs have dipped.</td>
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<td>Shift Based Team (SBT) meetings have a regular frequency with cross-functional attendance.</td>
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<td>Agenda for the meetings is always set in advance having KPIs and targets as the foundation</td>
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<td>There is a standardized procedure for root cause problem solving- including prioritization</td>
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<td>Actions from the RCPS are tracked and closed with clear ownership</td>
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<td>There is a high level of challenging among the participants in an RCPS session</td>
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<td>SBT meetings are run by shop floor team leaders regardless of the presence of senior managers</td>
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<td>Team leaders and site leadership team have a clear prioritized daily plan that they consistently follow</td>
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<td>Roles and responsibilities are clearly defined</td>
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<td>Leaders spend significant time coaching and holding people accountable for their role responsibilities</td>
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<tr>
<td>A clear training plan has been established to build employee skills</td>
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<tr>
<td>Briefly discuss what else should be done differently in order to drive performance improvements across the shifts.</td>
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<table>
<thead>
<tr>
<th>CAPABILITY</th>
<th>SA</th>
<th>A</th>
<th>N</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The challenge to improve is very evident- leaders set agendas and targets for us to achieve</td>
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<tr>
<td>People in my team are focused on delivering great results.</td>
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<tr>
<td>All leaders are strong role models and visible at shop floor</td>
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<tr>
<td>There is good collaboration between my team and other teams within the business.</td>
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<td>Change agents are embedded in the organization to drive continuous improvement and are seen as important.</td>
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<tr>
<td>People in my team are encouraged to come up with innovative solutions for customers.</td>
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<td>I am clear on the business objectives and how my role contributes to the whole.</td>
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<tr>
<td>I work beyond what is required in my job to help CGI succeed.</td>
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</tbody>
</table>
What other initiative(s) do you feel if implemented would improve staff productivity across the shop floor?

KEY:

SA – Strongly Agree
A – Agree
N – Neutral
D – Disagree
SD – Strongly Disagree

Source: http://www.diageodwbme.com

Thank you for taking time to complete this survey questionnaire.