IMPROVING EMPLOYEE PERFORMANCE THROUGH QUALITY IMPROVEMENT INITIATIVES - DMAIC ANALYSIS OF WARTSILA ZAMBIA

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KOULUTUSOHJELMA
Diplomityö
Toukokuu 2017
IMPROVING EMPLOYEE PERFORMANCE THROUGH QUALITY IMPROVEMENT INITIATIVES- DMAIC ANALYSIS OF WARTSILA ZAMBIA

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MASTERS DEGREE PROGRAMME

Thesis / May 2017
# Abstract

Organizations in recent times have experienced a period of massive change in their ways of operation due to the trend of increasing competition both at the local and international level. To succeed in the competing markets of today means that an organization should have good quality performance and quality improvement systems in place. Companies are beginning to realize that employee involvement is critical to quality performance and quality improvement making them essential to the total quality management strategy. This research focuses on investigating the main causes of the employee performance problems at the operations department of Wartsila Zambia using DMAIC analysis for quality improvement.

The study involved the use of SIX SIGMA to conduct a quality and continuous improvement assessment by assessing people, process, equipment, environment and management processes that contribute to the causes of slow progress of employees’ performance. The key areas under investigation were categorized into five sections to identify which aspect needs to be improved in order to ensure an increase in employee and organizational performance.

Primary data for the study were collected through a survey by distributing questionnaires to the employees working at the operations department of Wartsila Zambia. Secondary data from the company’s internal documentation, performance charts and reports, meeting minutes and company profile document were utilized to describe the research environment, case company operations and other background data for the DMAIC analysis. Questionnaires were designed based on previous literature, problems identified in root cause analysis and brainstorming. Results from the questionnaire were analysed, the implication of the responses from the study were explained and an overview of the areas which needs more attention were addressed based on the results from the study. The results were prioritized according to the mean score of responses and the most important findings were labelled high under each category.

The DMAIC analysis results indicate that there are several issues related to people, work process, machine and equipment, environment and managements at the target company. It also provided a platform for the improvement, monitoring and sustaining suggested improvements that leads to better performance. This study proposed that quality and performance improvement team needs to be put in place to monitor and sustain improvements. It also proposed that management should invest in the use of people and process-related dashboards to measure performance as an essential element in creating a SIX SIGMA culture of continuous improvement.

Further research should be carried to find out how successful this improvement project has been for the case company. Also, studies can be done to find the strength of relationships between continuous improvement initiatives like SIX SIGMA and employee performance as relationship with process optimization.

**Keywords:** Quality, Quality management, Continuous improvement, SIX SIGMA, Employee performance,
ACKNOWLEDGEMENTS

All thanks and praises to the Almighty God for successfully seeing me through my masters program. Secondly, my sincere gratitude goes to my professor Harri Haapasalo for the support, advice, encouragement and guidance throughout the thesis, second supervisor Dr, Osmo Kauppila for his suggestions, criticism and corrections, then to Mr Frank Berneverte former Operations Manager of Wartsila Zambia for his interest and suggestion on the thesis topic.

I am very grateful to my parents (Hajia Iyabo and Alhaji Issah Ayigoro), siblings, families, friends and colleagues at school and at work place for their support, encouragement, advice and constant prayers.

Finally, my greatest debt of thanks goes to my wife (Rukayat Salami). You endured my long absence. It would have been impossible for me to go through this programme without your support, prayers and encouragement. I love you!
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<td>Define Measure Analyze Improve and Control</td>
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<td>FMEA</td>
<td>Failure Mode and Effects Analysis</td>
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<td>ISO</td>
<td>International Organizations for Standardization</td>
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<tr>
<td>NECL</td>
<td>Ndola Energy Company Limited</td>
</tr>
<tr>
<td>PDSA</td>
<td>Plan Do Study and Act</td>
</tr>
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<td>QFD</td>
<td>Quality Function Deployment</td>
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<td>QI</td>
<td>Quality Improvement</td>
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<td>SIPOC</td>
<td>Suppliers Inputs Process Outputs Customers</td>
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<td>SPC</td>
<td>Statistical Process Control</td>
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<td>TQM</td>
<td>Total Quality Management</td>
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<td>VSM</td>
<td>Value Stream Mapping</td>
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1 INTRODUCTION

1.1 Background of Study

Organizations in recent times have experienced a period of massive change in their ways of operation due to the trend of increasing competition both at the domestic and international level. The increase in competition has created a hostile and turbulent environment for many organizations in the world today. Adding up to the pressure of the competition is the pace at which technology is changing and with consumers and regulators demand increasing every day (Christina, 2005). There are several strategic factors that an organization can implement to overcome the turbulence in the environment, have the edge for sustainable competitive advantage over its competitors and meet customer demand. Among all the strategies, good quality performance has always been the paramount factor for organizational success. To succeed in the competing markets of the twenty-first century means that an organization should have good quality performance and quality improvement systems in place (Oakland, 2015), (Eslamy, et al., 2014).

Companies are beginning to realize that employee involvement is critical to quality performance, and quality improvement making them essential to the total quality management strategy (Zakuan & Norhayati, 2012). This means that organization's success in quality performance, and quality improvement depends on employees' performance and continuous improvement in employee performance through a well thought off performance management strategy as this ensures sustained quality improvement within the organization. According to Lyons (2013), Employee Performance Management is a process for establishing a shared workforce understanding about what is to be achieved at an organization level. It is about aligning the organizational objectives with the employees' agreed measures, skills, competency requirements, development plans and the delivery of results. The emphasis is on improvement, learning and development in order to achieve the overall business strategy and to create a high performance workforce (www.peolestreme.com, 2017)

According to Chan & Lynn (1991), the organizational performance criteria should include profitability, productivity, marketing effectiveness, customer satisfaction, but also employee morale. In this perspective, employee performance is tightly related to organizational
performance, effective and efficient employee performance will positively influence organizational performance.

Zhang (2012) also notes that employees and managers need to understand that performance management and performance management systems are the key determinants of an organization's long-term success or failure. If employees are not happy or do not agree with the performance management system, they are likely to be unwilling to take an active part in the process because they do not see any value of it. As a result, the organizational performance and productivity would decrease due to the inefficient employee performance.

Creating a high performance workforce can be achieved through adoption of quality improvement initiatives. In this context, leading organizations increasingly emphasize on continuous process improvement through “data driven decision-making”. These improvements specifically focus on applying management skills to eliminate inefficiency and maximize value through optimization of processes within the organisation. The result is improved performance, fewer errors and increased efficiency and productivity (Ziaul, 2006).

There are several initiatives used for quality improvement which also focus on creating a high performance workforce and increasing productivity. Examples of such initiatives include the use of the six-sigma, total quality management (TQM), Lean, business process reengineering (BPR), theory of constraints (TOC) and the Plan-Do-Check-Act cycle (PDCA) developed by Walter A. Shewhart which was later modified to Plan-Do-Study-Act (PDSA) by W. Edwards Deming (Christina, 1999), (Eslamy, et al., 2014). “SIX SIGMA” is a business management system based on the rigorous, focused and systematic implementation of proven quality assurance principles and techniques. Developed by Motorola in the mid 1980’s, it has been popularized by leading organizations such as General Electric, Allied Signal, Ford, Honeywell and others. Incorporating elements from the work of many quality pioneers, SIX SIGMA aims for virtually error free business performance. The central idea behind SIX SIGMA is that if an organization can measure how many "defects" it has in a business process, it can systematically determine how to eliminate them and get as close to "zero defects" as possible (Angoss, 2011).
Angoss, (2011) notes that, the main thrust of SIX SIGMA is the application of a well-disciplined, easy to follow methodology to the optimization of discrete business activities that impact on corporate performance. Beyond this basic methodology, a system of leadership, support systems and technology tools has been evolving in many organizations. These organizational changes, which are central to SIX SIGMA success, reflect an increased emphasis on objective, data driven decision-making methodologies coupled with the disciplined application of methodologies and tools by empowered personnel to a broadening range of business operations.

SIX SIGMA initiatives have been credited with delivering substantial business value to adopting organizations in the form of: reduced product defects and improved quality, reduced production cycle times, lower inventory levels, higher productive efficiency, lower production costs. These benefits are realized through a systematic approach to problem solving which enables organizations to identify activity areas for problem resolution, assess causal factors that impact on defects in business processes, formulate and execute modifications in business processes to reduce these defects, measure results, and operationalize findings where improvements are observed. SIX SIGMA initiatives incorporate a rigorous “DMAIC” methodology comprises several steps: define, measure, analyse, improve and control. (Kholopane, 2016).

It is against this background that this study seeks to improve employee performance problems at Wartsila Zambia using DMAIC analysis with aim of making recommendations that will lead to improved employee performance and organizational productivity as well as serving as a framework for implementing continuous improvement at the organization. SIX SIGMA - DMAIC analysis will make it easy to answer the following questions; what are the areas that need to be improved in order to overcome the obstacles that are hindering the progress of employees under operations? What are the barriers that are preventing them from meeting their set target? In addition to this SIX SIGMA - DMAIC analysis does not only focus on
process to drive business performance and customer satisfaction but also uses measurement-based approach to managing and continually improving the contribution of another powerful driver of process performance: people

1.2 Statement of the Problem

Wartsila is a global leader in complete lifecycle power solutions for the marine and energy market. Wartsila product portfolio is categorized into three; Marine and Oil & Gas solutions, Energy (power plant) solutions and Service solutions. Wartsila Marine Solutions enhances the business of its marine and oil and gas industry customers by providing them with innovative products and integrated solutions that are safe, environmentally sustainable, flexible, efficient, and economically sound. Wartsila Energy Solutions is a leading global supplier of flexible baseload power plants of up to 600 MW operating on various gaseous and liquid fuels.

Wartsila Zambia was set up when Wartsila was awarded the operation and maintenance contract. Wartsila was also awarded a turnkey plus project (second phase) to install the same baseload capacity power plant by the same owner. Wartsila would also operate and maintain it for the same number of years as the first one. After two years of impacting or transferring knowledge to the local employees of Wartsila Zambia by the expatriate staff, the local employees were expected to take over the supervisory positions as per contractual agreement and management position in future. However the level of performance of the local employees is not up to standard envisaged. There has been so many rumors and arguments on the low level of performance of employees under operations. While there is a notion that: “it’s due to their low level of education”, others argue that: “the expats did not teach or train them well because they wanted to extend their stay”, others also saying: “local employees have no willingness to learn”, some also saying: “the salary difference between them and the maintenance department could be the effect”, and etc.

Quality and continuous improvement are one of the key priority areas in Wartsila. Wartsila is among the international companies which understand the importance of quality and continuous improvement. Wartsila is always striving for perfection and improvements in all
areas of its work to satisfy customer needs. Comparing Wartsila Europe and Wartsila Africa, evidence show that Wartsila Africa does not make use of the quality and continuous improvement tools to effect changes in its departments or other activities. It is based on this assumption of the importance of quality improvement that this study seeks to find out the areas, which need to be tackled in order to improve the performance of employees under the operations department, and help achieve the best standard performance in the second phase of the power plant in Wartsila Zambia using SIX SIGMA-DMAIC analysis.

Organizations that want to become industry leaders in both quality and business performance must move beyond process improvement and incorporate “people improvement” in their SIX SIGMA initiatives. Gaining top leadership support, developing quality-driven cultures, and more effectively managing the hidden driver of quality, that is people (Brewton, 2011).

1.3 Objectives of the Study and Research Questions

The main aim of this research is to investigate the main causes of employee performance problems at Wartsila Zambia using SIX SIGMA-DMAIC analysis with aim of making recommendations that will lead to improved employee performance and organizational productivity, as well as serving as a framework for implementing continuous improvement at the organization. To achieve this the study will pursue the following specific objectives:

- Apply SIX SIGMA-DMAIC analysis to find out the causes of slow progress of employees performance at Wartsila Zambia
- Define the areas that need to be improved to enhance employee performance.
- Make recommendations that will lead to improved employee performance and organizational productivity
- Develop a framework for implementing continuous improvement at Wartsila Zambia

To achieve the research objectives, the following questions are posed.

RQ1: What are the causes of slow progress of employees’ performance at Wartsila Zambia?
RQ2: What are the reasons behind the causes of slow progress of employees’ performance at Wartsila Zambia?
RQ3: How to improve employees’ performance Wartsila Zambia?

1.4 Structure of the Study

The research is structured into six chapters: the introduction to the study, literature review, research methods and materials, results analysis and discussion of the results and finally conclusion and recommendation.

In the introduction, the background of the study, aim and objectives, background assumption, and the research question are discussed. This gives an overview of how the entire research is designed from the general view to the specific objectives of the study.

The literature review of the study is discussed in chapter two. The chapter provides all the relevant theories and the framework under which the study was conducted so as to achieve the objectives of the study. This chapter also presents a literature review on quality, quality management, continuous improvement and quality tool, SIX SIGMA and employees’ performance.

The empirical part of the study which is captured in chapter four, gives a detailed investigation into the activities of the operations department of Wartsila Zambia using SIX SIGMA- DMAIC Analysis to locate process and people areas causing the performance problems and how they can be improved. Findings from questionnaires administered to the employees are analyzed using the SPSS. The results attained from the analysis were carefully interpreted and discussed in detail to give an understanding or translation of the results.

The last chapter of the study presents recommendations and conclusions of the results together with management implication of the study based on the results and data analyzed. Table 1 below shows the structure of the study.
Table 1: The Structure of the Study

| Introduction | Background of the study |
|             | Statement of the problem |
|             | Objectives and Research questions of study |
|             | Structure of the study |
| Literature review | Definition of Quality, |
|                 | Quality Management |
|                 | Continuous Improvement |
|                 | Quality Tools |
|                 | Employees performance |
|                 | SIX SIGMA and Employees performance improvement |
| Methodology    | Research design |
|                | Target population and research instrument and data collection |
|                | Data analysis |
| Results Analysis | Case company Wartsila Response rate |
|                | Definition of the problem |
|                | Measuring & Analyzing key area |
|                | Improve stage & Control Stage |
| Results discussions | |
| Conclusions and Recommendations | |
| Summary and further research | |
2 LITERATURE REVIEW

Chapter two presents available knowledge on quality management, continuous improvement, employees’ performance, the methods and tools used in quality improvement and a holistic view of the areas where the SIX SIGMA has been successfully implemented. This is to help gain a deeper understanding on how to improve employee performance using continuous improvement techniques.

2.1 Definition of Quality

There has been many definitions with regards to quality. These definitions vary from manufacturing to services, from academicians to practitioners, and from industries. Variation of quality happens just because of the intangible nature of the components associated with quality. According to Sower and Fair (2005), "quality experts have defined quality in many different ways and there are different perspectives that can be taken in defining quality". Crosby (2006) stated that: "There are many and many more definitions of quality", whereas according to Kara et al. (2005) "there is no general definition". Every quality expert defines the term differently. ISO definition of quality is the most widely accepted as "the degree to which a set of inherent characteristics fulfils requirements" (International Organization for Standardization, 1400).

Quality was defined as excellence with respect to the underlying dictionary definition (Peters & Waterman, 1982). Feigenbaum (1991), defines quality in respect to value, the degree of excellence in relation to price. Garvin (1987), also defines eight dimensions of quality (performance, features, reliability, durability, conformance, serviceability, aesthetics, and perceived quality) with respect to goods. Reed et al. (1996), stated that quality means continues meeting or exceeding customer expectations. Crosby (1984), focuses more on avoidance of defects and conformability to specifications. (Juran & Gryna, 1988), came up with a customer focus into manufacturing quality by defining quality as fitness for use. Parasuraman, et al. (1988) introduce customers' expectations and perceptions into the definition of service quality.
Definition of quality on a different perspective focuses on the development of a set of characteristics or categories of quality in multidimensional terms. Garvin (1988), categories quality into five groups: transcendent definitions, product based definitions, user based definitions, manufacturing based definitions and value based definitions. These definitions define quality in relation to costs and it is seen as providing good value in relation to cost. Garvin (1988), incorporates all three approaches (excellence or value, conformance to specifications, and customer focus) into his five definitions of quality.

Sahney et al., (2004), defines quality using two perspectives, either as attributed to the characteristics of a product or service or attributed to the production of a product or delivery of a service. Sahney et al. (2004), also included the importance of meeting and exceeding the expectations of the customers and the need to create customer satisfaction in the goods and services produced and/or delivered.

In the service industry, quality definitions tend to focus on meeting customer requirements and how well service providers meet their expectations (Lewis & Booms, 1983). Tarn (1999), defines quality as a subject to continuous change. Lagrosen (2001), found it important to define quality by the specific industry characteristics that help customer satisfaction for that specific industry or for specific situations encountered by the organization. Brooks (2005), found that defining quality would depend on the organizational purpose, customer base and other contextual factors. (Sower & Fair 2006), also found that the origin of definitions of quality dimensions do not apply to innovative products or paradigm- shifting products or services.

With regards to education, quality is seen as outcomes assessment (Ewell, 1994) and it also includes a strong stakeholder focus (Telford & Masson, 2005). Telford & Masson (2005) found that defining quality in higher education should include the criteria and perspectives of all the institutions stakeholders, where stakeholders would include "students, employers, teaching and non- teaching staff, government and its funding agencies, accreditors, validators, auditors, assessors, and the community at large". Sanvido, et al. (1992) and Barrett (2000) also defined quality as fulfilling expectations of all participants.
For example, in the health care, quality was discussed as the effectiveness, efficiency and access of health care, the values and satisfaction of patients, the attitude of health care workers, and problems such as medical errors and practice variations (Blumenthal, 1996; Harvey, 1996). (Lohr & Harris-Wehling, 1991), stated that “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” is defined as quality. Quality is defined as the degree to which the care provided is in line with medical professional criteria (Simons & Mansvelt, 1979).

According to Raisinghani et al. (2005) the new definition of quality must "include the utility of that which is produced to the end customer and must include the ability to outperform the competition by satisfying internal specification, or customer, requirements". Most researchers now agree that quality definition must consist either objective or that which can be measured according to specifications or that which is evaluated by the customer (Hoyer, et al., 2001). (Harvey & Green, 1993) also found that the difference in quality definition is "not about the different views on the same thing but different views on different things with the same label" and that the characteristics of quality are discrete but interrelated.

In summary, a new definition of quality must be important to the customer and service provider. The definition must include tangible measurements as well as customer based subjective elements or service process which cumulatively creates an emotional response to such a degree of satisfaction or dissatisfaction (Plutchik, 2000).

2.2 Quality Management

A quality management system is a methodological approach to improve processes, products, and services for delivering customer value and to drive continuous improvement to deliver high-quality products (Houston, 2008). The increased challenges in today’s business environment and international competitions make it possible for organizations to improve on their quality performance by aligning their quality practices in an attempt to improve on all possible areas for competitive advantage (Vecchi & Brennan, 2009). Dahlgaard et al, (1998)
stated that strong quality management orientation plays a vital role in spreading the quality philosophy through an entire organization.

Quality practitioners like Deming, Crosby, Juran and Gryna, Feigenbaum, Ishikawa and others have developed some number of propositions in the areas of quality management. Their understanding into quality management provides a good thoughtful of quality management dimensions (Zhang, 2000). According to Zhang el at. (2000), European Quality Award in Europe (1994); the Deming Prize (1992) in Japan and the Malcolm Baldrige National Quality Award (1997) in the USA are some Quality Award models that have provided a useful benchmark framework against which firms can evaluate their quality management methods, the deployment of these methods, and the end business results.

Quality Management is a systematic, proven approach to improvements in organizational performance (Lau & Idris, 2001). The quality management approach is dependent on several systematic tools such as (1) management and planning tools, (2) process analysis tools, (3) decision-making tools, (4) data collection tools, and (5) root cause analysis tools (Tague, 2005). The effect of good quality management practices is reflected in improved quality levels of internal operations, customer satisfaction, and market and financial performance (Ishikawa, 1985), (Juran & Gryna, 1988 ). Effective Quality Management implementation is said to result in both improved quality and reduced costs (Reitsperger & Daniel, 1991). According to Reed et al. (1996), firms with different strategic guidelines (customer versus operations) achieve financial performance through different channels associated with different Quality Management practices.

The framework of (Flynn, et al., 1994) for quality management research claims that quality management practices are the inputs and quality performance represents the outputs. Quiet number of empirical studies confirmed the positive effect of quality practices on corporate performance, cost reduction, customer satisfaction and on some other operational results (Powell, 1995), (Madu, et al., 1995). Ahmed et al. (2005), added that successful implementation of any quality management system depends vastly on the strong commitment of top management and how customers are valued.
2.3 Continuous Improvement

Quality improvement is a terminology that is used to include a vast array of tools, techniques and methodologies of which continuous improvement is a core methodology. Continuous improvement (CI) is described by Deming as a philosophy that is depicted simply as consisting of “Improvement initiatives that increase successes and reduce failures” (Juergensen, 2000). Continuous Improvement was also defined as “a company-wide process of focused and continuous incremental innovation” (Bessant, et al., 1994). According to Kossoff (1993), to achieve a successful total quality management comes with an involvement of everyone from all organizational levels to pursue and adapt to a constant continuous improvement. The ability and quickness to identify what is changing in the environment and react proactively through continuous improvement efforts has been characterized as a key element needed for organizational (Brown & Eisenhardt, 2000), (Hamel, 2000).

The Institute of Quality Assurance (www.iqa.org/information/d2-7.shtml, 2016) defines continuous improvement as a “gradual never-ending change which focuses on increasing the effectiveness and/or efficiency of an organization to fulfil its policy and objectives. It is not limited to quality initiatives. Improvement in business strategy, customer, employee, business results, and supplier relationships can be subject to continual improvement. Put simply, it means ‘getting better all the time’”. (Bhuiyan & Bagehel, 2005), defined CI as a “culture of sustained improvement targeting the elimination of waste in all systems and processes of an organization. They further stated that it involves everyone working together to make improvements without necessarily making huge capital investments”.

Martichenko (2004), stated that “to improve organizational performance is to focus more on continuous improvement”. Boer et al. (2000) who also described CI as “the planned, organized and ongoing systematical process, incremental and company-wide change of existing practices aimed at improving company performance”. Hyland et al. (2000) and Bessant et al. (1994), concentrated on defining CI as a systematical inclusion of all employees. Jha et al. (1996) combined a number of definitions of CI and concluded that customer focus is one of the key elements of CI and that Continuous Improvement was not
only about continual change but also evaluating outcomes of change and then taking informed actions to continue to improve the process

Some benefits that CI provides an organizations’ are; employees enjoy healthy workplace, satisfied customers needs and increased financial returns for a company (Woods, 1997). Bessant et al. (1994), believed that CI is of a great benefits in the sense that the financial investment required and the ability to utilize the ideas to all the employees is very low. Martichenko (2004), stated “organizations that do not adopt continuous improvement are likely to follow destructive patterns of reorganization, restructuring, layoffs and other reactionary management techniques that make executives feel they are doing what's right”. It was believed by (Cole, 2001), that CI was more about “organizational renewal and the efforts to prevent organizational ossification”. Alexander et al. (2006), found that involvement of a hospital in a longer period of time in quality improvement, leads to a higher cash flow and a lower cost per case.

Other benefits that could be gained from CI are; low capital investment, continually making small improvements and dramatic changes (Jha, et al., 1996), improving on quality and performance (Chassin, 1997), (Goh, 2000), reducing of waste and costs (Gallagher, et al., 1997), improving on customer satisfaction (Gallagher, et al., 1997), (Taylor & Hirst, 2001) and increasing of employees satisfaction (Temponi, 2001). Lastly, ideas and suggestions come from those who are actually doing the job, there is no monopoly on good ideas (Goh, 2000), (Taylor & Hirst, 2001).

### 2.4 Quality Tools

Quality management tools and techniques are practical methods, skills, or mechanisms that can be applied to particular tasks and also use to facilitate positive changes and improvements. ‘The use of tools and techniques is a vital component of any successful improvement process’ (Bunney & Dale, 1997). (Ahmed & Hassan, 2003) stated that quality management cannot be a success without the application of the appropriate tools and techniques, and firms with greater implementation of these tools and techniques can improve their business results. In order to determine the effectiveness of quality management systems,
quantifying quality improvement is essential and different tools and techniques are available for measuring quality improvement such as benchmarking, statistical process control and defect cost analysis. (Bunney & Dale, 1997) and Spring et al. (1998) stated that the application of quality tools and techniques within a problem solving methodology are essential to understand and facilitate improvement in any process.

Some distinctions between tools and techniques from some quality scholars. A Tool was described as a device which has a clear role and often narrow in focus and usually used on its own whereas technique, on the other hand, has a wider application than a tool which can be thought of as a collection of tools (McQuater, et al., 1995). Examples of tools are; cause and effect diagram, Pareto analysis, relationship diagram, control charts, histogram and flowchart (Christos, 2009). Examples of techniques are: SPC, benchmarking, quality function deployment, failure mode and effects analysis and design of experiments (McQuater, et al., 1995). (Bamford & Greatbanks, 2005), Hagemeyer et al. (2006) and Alsaleh (2007), made a distinction between the quality tools and techniques according to the facility in understanding and implementing them by the users.

(Kwok & Tummala, 1998), argued that some of the quality tools and techniques do not work exactly as they are intended, when firms try to apply them. The failures in Tools such as flowchart, check sheet, histogram and brainstorming are supposed to be simple or basic while the more complex techniques such as SPC, design of experiments, Taguchi’s methods and quality function deployment are supposed to be advanced or sophisticated applying quality tools and techniques are not due to the fact that they are ineffective, but due to lack of clear understanding regarding when, where and how to apply them.

According to McQuater et al. (1995), attention is required with the usage of tools and techniques in terms of a number of critical success factors, such as management support and commitment, effective, timely and planned training, genuine need to use a tool or technique, defined aims and objectives for use, co-operative environment and backup and support from improvement facilitators. Thia et al. (2005), identified two categories of factors affecting the adoption of quality tools: internal and external factors. User-friendliness, usefulness, time, monetary cost, flexibility and popularity of tools are internal factors which may influence
their usage. External factors such as project nature, organization, industries and culture, account for the external influence.

Lam (1996), studied companies in Hong Kong, half of which had implemented some company-wide TQM program. He found that quality tools usage was confined to relatively simple tools. The standard “seven quality control tools” such as control chart, cause and effect diagram, histogram and flowchart were popular, but most of the sophisticated quality techniques such as quality function deployment and design of experiment were used by fewer than 10 per cent of the responding companies.

Sousa et al. (2005), studied Portuguese SMEs certified to ISO 9001:2000. They found that the quality tools and techniques used by the majority of the companies, although moderately, were the easiest to understand and implement, quality tools such as graph, check sheet, process flowchart and histogram. However, companies did not seem to use tools such as control charts, scatter diagram and cause and effect diagram to a significant degree.

A survey was conducted by (Alsaleh, 2007), from a sample of Saudi Arabia food industry. The findings show that industries are enthusiasm regarding the quality awards and more than two-thirds of the surveyed companies possessed a quality award. Quality tools such as control charts, histogram and run chart appeared to be the commonest ones being utilized throughout the production stages at one-third of the surveyed companies.

Ishikawa (1985) and McConnell (1989), recognized and came up with a list of seven TQM tools as: flow charts, cause and effect diagrams, Pareto charts, histograms, run charts and graphs, X-bar and R-control charts and scatter diagrams. McQuater et al. (1995), also list quality tools as follows; cause and effect diagrams, Pareto analysis, Relationship diagrams, control charts, histograms and flow charts. According to (Geotsch & Davis, 2010), the seven basic quality tools are; Pareto chart, fishbone, check sheet, histogram, scatter diagram, control chart and run diagram.

Fishbone
This is called fishbone because the diagram looks like fishbone but it is also popularly known as Cause-and-Effect diagram. (Geotsch & Davis 2010), stated that it is the only statistics process control tool that is not statistics base. The fishbone diagram explores all the possible causes of problems available in order to unveil the source of the cause (Mitra, 1998).

**Check sheet**

This is a simple tool for collecting data (David et al., 2005), use for facilitating systematic records and use in arranging data which have been observed manually (Mitra, 1998). Check sheet is useful in recording key data (Salih et al., 1995).

**Pareto chart**

Pareto chart is more useful when there is the need of segregating the vital from the trivial (Goetsch & Davis, 2010). This goes with the idea of Pareto principle that is 80-20. Which means among all the associated problems one do faced in an organization, 20% of them will account for quality failures (He, et al., 1996). Pareto chart is also used to analyze and indicate factors which need to be first improve before eliminating defects, however, by doing that the higher possible improvement can be achieved (Salih et al., 1995).

**Histogram**

Histogram is a graphical tool for displaying large amount of data, is normally use at the instance where is quiet hard to interpret data at their raw (He, et al., 1996), (Mitra, 1998). Histogram graphically represents frequency that occur with regards to a specific group of data points (McQuater, et al., 1995). According to David et al. (2005), histogram tabulates data and provides a very clear picture view of the end result.

**Scatter diagram**

Scatter diagram is one of the most simple and useful tool among the SPC tools (Goetsch & Davis, 2010). Scatter diagram is used to display graphically the correlation between variables. Scatter diagram most often also used to find out whether the cause and effect analyses really have connections with the characteristics.

**Control chart**
Control chart is used to monitor and as well control ongoing process. However, it also determine if the process is working as planned, the stability of the process and as well provide solutions to process failure (Bunney & Dale, 1997). Control Chart is the strong hold among the SPC tools, use to determine the trend among the available data and it matches the old process with the new to analyze the effective measures of improvement.

**Affinity diagram**
Affinity diagram is used to enhance critical thinking, a brainstorming tool that helps in gathering facts, opinion and ideas with regards to customer needs. An affinity diagram is used to organize ideas into categories based on underlying similarity of data generated during interviews, brainstorming, and group discussions (Pyzdek & Keller, 2014) and (Shafer, et al., 2005). Affinity serves as a platform that allow creative process ideas to be discuss, improve or brainstorm among individual that are involve (He, et al., 1996).

**Benchmarking**
Benchmarking according to Geotsch & Davis (2010), has been in existence during the beginning of 1980s, but then it has not been globally recognized as means of organization performance improvement tool. Benchmarking is a technique used by an organization to compare and measure the performance of their practices and operations with other best companies within or outside the industry. This strategy helps the organization to stay competitive and as well as come out with best performance to satisfy customers’ needs (Sun, 2010), (Tavana, et al., 2003) (Maire, et al., 2008).

**Quality auditing**
Quality auditing is a means of checking the effectiveness and efficiency of measurement control programs utilized by organizations. The quality auditing practice is put in place to sort out failures which occurs in measurement control programs (Mitra, 1998). According to Willborn (1989), quality auditing play a vital role in achieving quality management aims, (Jain et. al, 2016) examined current performance and compare if they meet quality standards

**Balanced Scorecard**
The Balanced Scorecard (BSC) is a performance management system that enables any organization irrespective of the size to set their vision and strategy and translate them into action. The BSC provides an organization with feedbacks of both the internal business processes and external outcomes. It is centered on four performance perspectives such as financial perspective, customer perspective, internal Business perspective and Learning & Growth perspective. Creating a balanced scorecard helps organizations to know how feasible their objectives are (Leonardo & Fons, 2011): (Smandek, et al., 2010).

2.4.1 SIX SIGMA

SIX SIGMA is a powerful business strategy that helps in yielding a dramatic reduction of defects, errors, or mistakes in service processes (Antony, 2005). SIX SIGMA is a powerful methodology which was developed to accelerate quality improvement in service sectors by focusing relentlessly on reducing process variation and eliminating non-value added steps or tasks (Kwak & Anbari, 2004). Although SIX SIGMA methodological approach to quality and process improvement has been used by manufacturing organizations predominantly, these days SIX SIGMA is growing exponentially and becoming more popular in some other sectors like: banks, hospitals, financial services, airline industry, utility services etc. (Antony, et al., 2007). Snee (1999) points out that SIX SIGMA is not believed to be something new by some people and it is believed to be very unique in its approach and deployment; it is a strategic business improvement approach that aids to increase both customer satisfaction and an organization’s financial health.

There have been many researches and studies on SIX SIGMA over the years. SIX SIGMA has been characterized as the current management fad to change old quality management principles, practices, and tools/techniques (Clifford, 2001). There have been many books and articles on SIX SIGMA written by practitioners and consultants in the last decade and only a few academic articles published in scholarly journals (Linderman, et al., 2003).

The following are some example definitions of SIX SIGMA that reflect in different perspectives. Quality Progress defined SIX SIGMA as a “high-performance, data-driven approach to analyzing the root causes of business problems and solving them” (Blakeslee &
(Harry & Schroeder, 2000), in their popular book on SIX SIGMA, described SIX SIGMA as a “business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimize waste and resources while increasing customer satisfaction”. According to description of Hahn et al, (2000), SIX SIGMA is a disciplined and statistically based approach which is used to improve product and process quality. (Sanders & Hold, 2000), also describes it as a management strategy that requires a culture change in the organization.

Ang et al. (2015), in their article stated that “SIX SIGMA is a business strategy used to support organizations to improve their organizational efficiencies and customer satisfaction”. On the other hand, Hikmet et al. (2015) defined “SIX SIGMA as the process of quality management that directs us to excellent quality level via continual improvement process”. Anderson et al. (2006), also defined SIX SIGMA as: “Improvement program for reducing variation, which focuses on continuous and breakthrough improvements”. Antony (2002), stated that “SIX SIGMA is a business performance improvement strategy with the aims that some number of mistakes can be reduced to as low as 3.4 occasions per million opportunities”.

According to (Antony & Banuelas, 2002), “SIX SIGMA is a philosophy that employs a well-structured continuous improvement methodology to reduce process variability and drive out waste within the business processes using statistical tools and techniques”. According to Bendell (2006), SIX SIGMA is a company-wide strategic approach focusing on reducing variations and with a potential effect of reducing both cost and increasing customer satisfaction at the same time. (Chakrabarty & Tan, 2007), stated that SIX SIGMA is “a quality program for improvement with the aim of minimizing occurrence of defects to as low as 3.4 parts per million opportunities or 0.0003 per cent”. (Kwak & Anbari, 2006), defined SIX SIGMA as “a business strategy used to improve profitability of a business, effectiveness of that business and all operations efficiencies to meet or exceed customer needs and expectations”.

(Black & Revere, 2006) defined SIX SIGMA “as a quality movement, a methodology, and a measurement. As a quality movement, SIX SIGMA is a major player in both manufacturing
and service industries throughout the world. As a methodology, it is used to evaluate the capability of a process to perform defect-free, where a defect is defined as anything that results in customer dissatisfaction”.

It is evident that the SIX SIGMA is nothing but a customer focused strategy that helps eliminate any form of errors and improves efficiency (Hikmet, et al., 2015). Some added that the SIX SIGMA methodologies rely on different statistical techniques to produce accurate findings. SIX SIGMA was defined by them as a quality improvement approach that improve organizational performance based on the use of various statistic and analytic techniques (Surendro, 2013). The sigma (σ) is the symbol for standard deviation and it is just the measurement for statistical dispersion and spreading, to this effect it is argued that the bases of the SIX SIGMA is related to statistics (Hikmet, et al., 2015).

Basic concepts and benefits of the SIX SIGMA methodology have been mentioned in many different books and articles (Harry & Schroeder, 2000). SIX SIGMA has also been discussed as a design for excellence and managerial thoughts, rather than a purely statistical concept (Yilmaz & Chatterjee, 2000). Well-known statistician and a quality consultant Snee (2000) pointed out in his studies that “SIX SIGMA should be approached systematically in other to work across all processes, products, company functions and industries”’. The idea was emphasized and pinned as a ”nuts and bolts” point-counterpoint discussion of each of 14 key SIX SIGMA ideas (Bajaria, 2000).

Achieving successful implementation of SIX SIGMA and a greater output, comes with some key elements which should be taken into consideration as stated by (Pande, et al., 2000) and others in a similar studies (Henderson & Evans, 2000) (Eckes, 2000). Top management involvement and provisions of appropriate resources and training leads to a successful initiation of SIX SIGMA (Halliday, 2001). CEO of GE, Jack Welch, has strongly impacted and enabled the restructuring of the business organization and changed the attitude of the employees towards SIX SIGMA (Henderson & Evans, 2000). The true importance of SIX SIGMA initiative will be in doubt and the energy behind it will be weakened if there is no continuous support and commitment from top management (Pande, et al., 2000).
Organizations that have achieved success in both local and international markets depend heavily on the culture of that particular organization (Sohal, 1998). It would be a great ideal to create a plan for communication that would explain why SIX SIGMA is important, and how its methodology works in organizations (Hendricks & Kelbaugh, 1998). Making SIX SIGMA a part of everyday life and pushing for culture change is also very essential in restructuring of organizations (Antony & Banuelas, 2002). Publishing results, after implementation of SIX SIGMA projects is a very good idea regardless of its outcome. Publications should not be only on success but also agreeing and communicating stumbling blocks. CEO or vice-president are considered as the SIX SIGMA champion, they are also suggested to lead SIX SIGMA initiatives and followed by the formation of master black belts, black belts, green belts and other team members who are individuals who support specific projects in their area (Harry & Schroeder, 2000).

Treating SIX SIGMA as another stand-alone activity is not possible. It requires devotion and support to a whole philosophy rather than just the usage of a few tools and techniques of quality improvement (Dale, 2000). SIX SIGMA projects and other activities link to customers, core processes and competitiveness needs to be very clear (Pande, et al., 2000). A set of propositions on SIX SIGMA from a goal-theoretic perspective were developed (Linderman, et al., 2003). Schroeder et al., (2003) provided a good definition of SIX SIGMA with a comparison to other quality management approaches.

### 2.4.2 SIX SIGMA Problem Solving Process

SIX SIGMA process improvement is a methodological step which follows a five step-by-step phase of Define, Measure, Analyze, Improve and Control (DMAIC). The DMAIC has five phases with which each phase has its systematic steps and the use of relevant tools during implementation process (Prashar, 2014). These processes were designed or deployed in order to have a better understanding of an arising issue and find ways of tackling them (Ang, et al., 2015), (Christyanti, 2012). The process tries to eliminate unproductive steps by concentrating on new measures and apply steps for continuous improvement. (Christyanti, 2012), (Michael, et al., 2005).
The basic framework of DMAIC works in a wide area of problem solving more especially in this twenty first century where fulfilling of customer demands is key to the survival of any given organization. (Michael, et al., 2005). Due to the success and effectiveness of the implementation of these processes, it was later used widely by organizations to improve upon the quality of performance, efficiency of operations, cost reduction and customer satisfaction (Jeroen & Joran, 2012). Figure 1, below shows the DMAIC steps.

![DMAIC steps](image)

**Define Stage**

This is the first stage of the roadmap and as well the starting point of defining the process and the core process variables out, and the technical and customer requirement (Miguel, et al., 2012). This stage mostly uses some SPC tools, lean tools and other quality management tools such as VSM, tree diagram, affinity diagram, brainstorming and SIPOC.

This step includes; validation of problem statements and goals, reviewing of project charter, validation of financial benefits, validation of high level stream map and scope, creating of communication plan, selecting and launching of the team to handle the project and developing a project schedule (Michael, et al., 2005), (Surendro, 2013).
Measure Stage

This stage measures the performance of quality of the current process; it may include data collection and evaluation of data to identify the performance of a given process (Surendro, 2013). Several organizations have setup a plan to help them define the scope or problem they need to be looked into. This step includes; value stream mapping for deeper understanding, identifying key input process and output metrics, developing of data collection plan, developing operational definitions, validation of measurement systems, collection of baseline date and determine process capability (Michael, et al., 2005), (Surendro, 2013). It is involved in measuring of current performances, clear view of the process, considering the risks in the process outcome and analyze and create measurement systems. Tools such as SIPOC, VSM, QFD, FMEA and other quality management tools can be used during this phase (Goetsch & Davis, 2010).

Analyze Stage

The main objective of analyze phase is to help the analysis of the performance of any given system to separate all the necessary problems. (Surendro, 2013). This is seen as a crucial phase of DMAIC in the sense that any wrong analysis carried out would lead to identifying the wrong problem rather than actual problem. Identification of influencing factors and the main causes can be carried out by first trying to identify the potential influencing factors and selection of the few vital factors. This can be successfully done if the scope of the entire DMAIC phases are carefully and well planned. (Jeroen & Joran, 2012)

Furthermore, the analyze phase of DMAIC can be achieved by determining the critical inputs, identifying all the potential root cause of a problem, reducing the list of all the potential root cause, confirming the potential effect of the root cause on the output, estimate the potential damage of effect of this root cause on the output and prioritizing the root cause in accordance with the effect they have on the output. When this is successfully done, it can help in the analysis phase in order to effectively detect the cause of a problem (Michael, et al., 2005), (Jeroen & Joran, 2012).

Improve Stage
This phase basically seeks to improve upon the performance based on the analysis made by given solutions to the potential problem that has been analyzed (Surendro, 2013). Some organizations have their own process they follow to help improve upon their process, they start by developing potential solutions to the problems that have been analyzed, then they select and prioritize the best solution, develop a value stream map after which they try to develop and implement a pilot solution, confirm the attainment of their project goals and finally develop a full scale implementation plan based on the result of their pilot solution (Michael, et al., 2005).

**Control Stage**

The control phase of DMAIC is to help control the process or product which has been improved to ensure that the target for the entire process or project is attained. It is just not enough to go through the entire phase of SIX SIGMA and no measures in place to control the output of the process (Surendro, 2013). The verification of the results of the project and other activities such as adjustment of the process management and control system need to be carried out to ensure that all the improvement made are sustained over a long period and continuously improved upon. This can be done by determining new process capabilities and always seeking to implement control plans (Jeroen & Joran, 2012), (Oakland, 2015).

Organizations can implement an ongoing process measurement to ensure that the solutions implemented to the cause of problems are effective. They can also identify opportunities to apply project lessons to help keep the system or process under control (Michael, et al., 2005), This phase consists of activities such as finalizing control system and verifying future capabilities (Goetsch & Davis, 2010), (Miguel, et al., 2012).

### 2.5 Employee Performance

Today’s competitive market shows that improving on the quality of employees’ performance is seen as an intellectual key to the financial performance of any given organization. Employee performance can be defined as direct or indirect contribution of an employee to the total output of any given organization (Hatane, 2015). (Mathis & Jackson, 2002), suggest that employees’ performance refers to the contribution of employee to the organization.
Employees performance is an important factor that contributes to the increase outcomes, improve positive behavior and characteristics of employees, as well as helping to increase the productivity of organization (Zahargier & Balasudaram, 2011). Kohli et al. (1998), stated that organizations that support learning in order to support the growth of their employees are able to achieve better performance improvement.

Cascio (1995), argues that the performance of an employee is the accomplishment of the tasks that have been set. Tinofirei (2011), concludes that employees performance is successful in the accomplishment of tasks as set and measured by supervisor based on acceptable standard that has been established, utilized the available resources efficiently and effectively. Bickle et al. (2008), suggest three components in employee performance. First is task performance, which is the employee contribution to the performance of organization which refers to actions that are part of formal reward system. Second is contextual performance, it includes the employee behavior that supports the organizational social and psychological environment which indirectly contributes to organizational performance. Third, is the ability of employees to adapt (adaptive performance, it can be seen from the employees ability to resolve the unforeseen or unexpected events in his work and can adjust to changes and innovations that occur in the company).

A direct relationship between employees’ performance and job satisfaction. The commitment of top management to increase employee satisfaction by taking into account the factors that influence employee satisfaction will be able to encourage employees to improve the performance of their duties, so as to contribute to the growth of the company (Shaw, et al., 1998). Kidd (2006), defines the employee satisfaction as the feeling that employees have on the jobs; the experience of job in the relation to past experience, current expectation and the alternatives that exist in the future. (Bhatti & Shahzad, 2008), show in their study that employees with job satisfaction will produce higher quality of work and their commitment level to the company will also be high, therefore their wish to leave the organization will be very low.

Employee performance and job satisfaction in other way contribute to the performance of an organization (Hwang & Chi, 2005). (Antoncic & Antoncic, 2011), find that employee job
satisfaction has a positive impact on the organizational performance. In other for organization to improve its overall performance and maintain or improve its level in the high competitive market, high level of consistent performance from the employees is needed (Newstrom & Davies, 2002).

2.5.1 Drivers of Employees Performance

From the preceding section it has been established that employee performance has a positive impact on organization performance. It is therefore important to know what drives employee performance in an organization to ensure that organizations achieve the level performance they set for themselves. The drivers identified in literature are discussed below.

Leadership

One of the factors which is considered as a major influence on the performance of organizations, managers and employees is leadership (Wang, et al., 2005). Bass (1985), stated that employees’ select to execute tasks out of identification with the leader or with the organization. Wang et al. (2005) suggest that leaders are mentors or role models to their subordinates and that they are not passive role recipients, as they may reject, embrace, or renegotiate roles prescribed by their leaders. Leadership in an organization is mostly the ability to motivate people to execute their duties within stipulated time using encouraging words and motivational methods instead of power or authority (Kotter, 1996), (Yammarino & Dubinsky, 1994).

Organizational Politics

Recently, different studies have shown that organizational politics is an important antecedent of employees' performance, both formal and informal (Ferris, et al., 2002), (Allen, et al., 1979), (Ferris & Kacmar, 1992), (Kipnis, et al., 1980), (Pfeffer, 1992). Studies have mainly focused on employees' perceptions of organizational politics, defined by (Ferris, et al., 1989) as behavior strategically designed to increase self-interests and therefore contradict the collective organizational goals or the interests of other individuals.

Communication
A contributing factor to low performance is poor communication between employees and management or between subordinates and superiors. Poor communication creates jealousies, barriers, staff distrust and the encouragement of rumors. If rumors are not dealt with very well, credibility may be given to the false information (Freeman, 1999).

**Procedures and Roles**

Performance can also be affected by poor organizational procedures, roles and directives. If a mission statement is not clearly stated, employees may have difficulty performing their duties without correct information (Garland, 2002). A clear mission statement must include definition of organizational principles, goals and practices.

**Effective Reward System**

An effective reward system help an organization to be more competitive, retains key employees performing very well and such reward system should relate to the employees productivity. Furthermore, efficient reward system can be a good motivator on the other hand, demotivation of employees is regarded as an inefficient reward system. (Reio & Callahon, 2004), conclude employees are motivated with both internal and external rewards and help leads them towards actualization of organizational goals.

**Adequate Training**

Giving employees proper training is one of the most important asset that will improve employee's morale and performance (Hills, 2002). Training is essential for employees due to the constant evolving methodology facing the assignment of duties at work. Performance will be low if superiors or leaders are not with adequate training and professional qualifications in order to achieve specific tasks (Watson, 2002).

**2.6 SIX SIGMA and Employee Performance Improvement**

Human resources is no different than any other aspect of a business in being able to deliver SIX SIGMA projects with significant financial benefits to the company. Projects are directed toward the internal customer by conducting human resources functions faster and more
efficiently, or toward the external customer by contributing to the ongoing transformation of
the company toward achievement of a well-functioning SIX SIGMA program (Muir, 2016).

According to Scoty (2012), continuous improvement strategy, SIX SIGMA methods, tools,
and processes have the potential to improve employee productivity and performance by
engaging them at all levels. He noted further that SIX SIGMA has taught us that the right
initiatives develop and teach employees how to eliminate waste, build process consistency,
and attain cost savings. The result is higher employee satisfaction and less absenteeism.

Milstead (2015), notes that SIX SIGMA principles and strategies have been used for years,
but some business owners are just beginning to see the benefits of using these tools. One of
the biggest benefits of SIX SIGMA is increased productivity. Increasing productivity is one
of the best things you can do to strengthen your company, as it leads to lower production
costs and higher profits. Motivated employees will naturally be more productive than those
who are unmotivated. There are techniques and tools from SIX SIGMA that are specifically
designed to promote employee engagement and create systems of motivation that will work
for the employees of your specific company. It’s important to remember that all companies
are different and the employee reward systems that work for some companies may not be
motivating for the employees of other companies. SIX SIGMA will individualize a system
for your employees. Some companies have increased productivity by as much as 50 percent
just by engaging their employees fully. Using SIX SIGMA is an excellent way to improve the
overall productivity of your company, as well as attract and keep valuable and productive
employees.

Liu et al (2013), investigated SIX SIGMA approach to performance management. The study
set up a model for DL Motorola workforce performance management process using SIX
SIGMA and Motorola Performance Management Simplification Project. They wanted to find
out if SIX SIGMA can be utilized to compensate for the defect of performance management
and enhance the satisfaction of related parts. The study revealed that, SIX SIGMA is an
effective and cost saving method in performance management.
3 METHODOLOGY

3.1 Research Design

According to Vogt (2011), research design is the science and art of planning procedures for conducting studies so as to get the most valid findings. In this regard, research design offers the strategy to direct this study.

This study employs a descriptive quantitative case study approach using SIX SIGMA-DMAIC analysis to investigate and improve employee performance at Wartsila Zambia. The descriptive research attempts to describe, explain and interpret conditions of the present i.e. “what is”. The purpose of a descriptive research is to examine a phenomenon that is occurring at a specific place(s) and time. A descriptive research is concerned with conditions, practices, structures, differences or relationships that exist, opinions held processes that are going on or trends that are evident. Mugenda (2008), describes descriptive study as a study concerned with finding out the what, where and how of a phenomenon and as such enabled the study to achieve its objectives.

According to Tellis (1997), through case study methods a researcher is able to go beyond the quantitative statistical results and understand the behavioral conditions through the actor’s perspective. By including both quantitative and qualitative data, case study helps explain both the process and outcome of a phenomenon through complete observation, reconstruction and analysis of the cases under investigation.

SIX SIGMA – DMAIC analysis process improvement project tool is used to investigate and improve employee performance at Wartsila Zambia. Figure 2, below shows the view of the DMAIC analysis method used in this study. Define means to establish either customer requirements or business requirements or both, in other words to determine “what is important”. Measure means to characterize performance of current process, in other words to find out “how is the process doing right now”. Analyse means to decompose causes that lead to deficiency that is finding out “what is wrong”. Improve means to modify present
performance, which is deciding “what needs to be done”. Finally control means to ensure consistency in improvement, meaning “how to guarantee improved performance”

The DMAIC steps were used in all the stages. Figure 2, below shows the phases of SIX SIGMA and how it was utilized.

![SIX SIGMA-DMAIC Analysis Steps Used](image)

**Figure 2: SIX SIGMA-DMAIC Analysis Steps Used**

### 3.2 Target Population, Research Instruments and Data Collection

The study involved the practical use of SIX SIGMA to conduct a quality and continuous improvement assessment by assessing improvement in the areas of people, process, equipment, environment and management.

Primary data for the study were collected through a survey by distributing questionnaires to the employees working at the operations department of Wartsila Zambia. Secondary
data from the company’s internal documentation - performance charts and reports, meeting minutes and company profile document were utilized to describe the research environment, case company operations and other background data for the DMAIC analysis.

The target population for this study were employees at the operations department of Wartsila Zambia. Because this study’s focus was on performance improvement, all the staff of this department were asked to take part in the survey. So no sampling took place as the entire population took part in the survey.

Questionnaires were designed based on problems identified in root cause analysis and brainstorming and sent for review and standardization. After this it was administered to the entire operation team (thesis questionnaire shown in appendix 1). It was discussed with the respondents to specifically ignore their personal prejudices and use their best judgment to answer survey questions on a 5 point Likert scale. The purpose of this exercise was to make the response a true reflection of organization reality rather than an individual opinion. The 5 point scale used in the questionnaire was; 1: Strongly agree 2: Agree 3: Strongly disagree 4: Disagree 5: Neither agree nor disagree

3.3 Data Analysis

At the problem definition stage of DMAIC analysis, Voice Of the Customer (VOC), in this case the employees) and brainstorming are used to solicit and structure all the problems associated with employee performance. At the measuring stage Root Cause Analysis and Cause and Effect Diagram is used to present what is wrong with employee performance at the company. These gives a better understanding of the root causes.

At the analysis stage descriptive statistics such as tables, means, check sheet and histogram were used to provide a graphical representation of results from the study. This answers research question two by giving a better understanding which areas has the most occurring frequency and needs to be given more attention and prioritized in other to achieve operational excellence.
4 RESULTS ANALYSIS

4.1 Case Company Wartsila

Wartsila is a global leader in complete lifecycle power solutions for the marine and energy market. Wartsila product portfolio is categorized into three; Marine and Oil & Gas solutions, Energy (power plant) solutions and Service solutions. Wartsila Marine Solutions enhances the business of its marine and oil and gas industry customers by providing them with innovative products and integrated solutions that are safe, environmentally sustainable, flexible, efficient, and economically sound. Wartsila Energy Solutions is a leading global supplier of flexible baseload power plants of up to 600 MW operating on various gaseous and liquid fuels. Their Portfolio includes unique solutions for peaking, reserve and load following power generation, as well as for balancing intermittent power production. Wartsila Services supports its customers throughout the lifecycle of their installations by optimizing efficiency and performance.

Wartsila provides the most comprehensive portfolio of services and the broadest service network in the industry, for both the energy and marine markets. Wartsila Service solutions is the cash cow of the company in that case every area needs to be tackled in order to continue yielding more profits to the company. A department in one of the branches under Wartsila Services Africa used as a case study company.

4.1.1 Wartsila Southern Africa

Wartsila South Africa (WZA) is the headquarters of Wartsila southern Africa with its current branch offices in Mozambique, Madagascar and Zambia, it covers 12 countries that include: Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Reunion Island, Swaziland, Zambia and South Africa. The company serves in South of Africa total installed engine base of 1,300 MW (858 MW Power Plant and 442 MW Marine) in the region under its responsibility. WZA is an ISO certified company implementing a quality management system ISO 9001:2008.

WZA offers multi-fuel solutions for power generation markets, from baseload generation to peaking and load following, as well as dynamic system balancing and ultra-fast grid reserve
for current and future capacity markets. Their fast track deliveries of complete power plants, together with long-term operation and maintenance agreements, offer their customers flexible capacity in both urban areas and the most demanding remote environments.

On the ship power WZA has experience in providing propulsion, powering, and environmental solutions for Navy and Coast Guard vessels in long standing, and more than 90 countries entrust Wartsila with the supply of equipment for their naval fleet. WZA provides environmentally and economically sound integrated solutions for technically complex vessels, such as research vessels, dredgers, and maintenance vessels. WZA Services is responsible for serving customers in various countries, providing services such as 4 stroke, 2 stroke, propulsion metallurgic repair and new cast of small propellers for the local fishing market.

Wartsila Zambia Ltd. was used as a case company in this research. Wartsila Zambia consists of three departments and only one department was considered as not meeting the expectations in terms of performance. The results from the study helped in making the necessary arrangement in order for employees to meet their set target. This study involved the practical use of SIX SIGMA to conduct a quality improvement assessment by trying to assess certain variables such as people, process, equipment, environment and management. Figure 3, below gives an overview of the structure of Wartsila Africa.

4.1.2 Wartsila Zambia

Ndola Energy power plant is the first contract won by Wartsila in Zambia with full installation and operations & maintenance agreement. Wartsila would use this great opportunity to create more businesses and expand their market in Zambia. Wartsila Zambia started full operations and maintenance of installed power plant in 2013 to help boost the energy sector of the country. Demand for energy is growing day by day as population is increasing and with regards to the shortage of water in the hydro dam being the biggest source of energy with more than 50% of power generation. Wartsila Zambia is situated in Ndola city in the province of Copperbelt. The power plant has total of six engines with a total
power generation capacity of 48MW/H. The engines are four-stroke diesel engines with direct fuel injection and drives a synchronous three-phase generator.

**Figure 3: Structure of Wartsila Services Africa**

(Wartsila *Company Profile 2016*)

Wartsila Zambia acting as a contractor (operator) to the local company “Ndola Energy Company Limited (NECL)”. Wartsila Zambia has a contractual agreement with NECL to
provide Operations and Maintenance management of the installed baseload of 48MW power plant for 5 years with the possibilities of another 5 years upon work satisfactions. Wartsila Zambia consists of three departments namely: Administration, Operations and Maintenance. For the purpose of this study, Operations department was only considered.

Operations department is responsible for ensuring continuous power generation, fulfilling the daily dispatch to a utility company Zambia Electricity Supply Company (ZESCO) and safety of the equipment. Other scope of work carried out under this department are starting up the plant, starting and stopping equipment, plant supervision and log keeping, daily routines, inspection and operation check, standby routine check, fuel quality check, lubricating oil quality check, water quality check, abnormal and emergency operation check, alarms and fault findings,

Wartsila Zambia has a total of 37 employees, out of which 19 work under operation. Operations department includes: operations manager and assistant, shift supervisors, operators and a bunkering crew and two trainees on 1 year graduate program. Operations manager manages employees and oversees all activities under the department. There are four shift supervisors who work on rotation as the power plant runs on 24 hours per day. Each shift supervisor has three operators working under them. The duty of each shift supervisor is to supervise the work of his/her operators and gives update performance of plant to the manager. Three operators in each shift with different responsibilities, their duties are; to monitor the performance of the power plant in the control room through an operating interface system, to monitor actual performance and visual inspections of the power plant in the engine hall and outside the engine hall, thus, the auxiliary system. Bunkering crew are in charge of all activities concerning fuel and lubricating oil. Figure 4, shows the organizational structure of Wartsila Zambia Ltd.
Figure 4: The Organizational Structure of Wartsila Zambia

(Wartsila Company Profile 2016)
4.2 Response Rate

Total of twenty one data gathered from the questionnaires administered to the entire operations department were analysed. Only one female is among the total employee. Almost 75% of the employees started working from the start of the business and the remaining joined later on a different period. The questions were designed to facilitate the respondents to identify various variables contributing to improvement of working performance.

4.3 Definition of the Problem

The scope of the research was discussed with the operations manager who has an interest in the department and how this research would be a benefit to the department and the organization as a whole. Assumptions of many people in Wartsila Zambia regarding performance of employees under operations department offer the best opportunities to investigate the root causes of slow progress of employees’ performance. Further problems or mistakes which arise under the same department that lead to frustrations and anger of the customer for contract cancellations call the attention of the top management for immediate interventions. A general meeting was held with the top management from outside Zambia and the entire employees under operations.

Total of 24 people participated in the general meeting which included; Service Unit Contract Manager & Contract Manager for SU East Africa and the Assistant, Contract Manager Zambia, Operations Manager, Shift Supervisors, Operators, Bunkering crew and Trainees. An opportunity was given to everyone to speak out on problem concerning the department and the work. Finally brainstorming of issues raised were discussed and some causes of the problems were noted and detailed. A detailed assessment of performance was carried out and appropriate interventions were made so as to show how to improve the performance of employees.

4.4 Measuring

This section answers the first research question, analyzing causes of slow progress of employees’ performance using the tools at measuring stage of SIX SIGMA-DMAIC analysis.
Based on the problems defined, a detailed root-cause analysis is presented in cause and effect diagram as shown in figure 5. Results included employees (such as lack of training), process (lack of standardized procedures), environment (noise and vibration), Equipment (lack of basic technical knowledge and understanding) and management (wrong selection or pairing of team members). Detailed results are shown on the Cause and Effect diagram is presented in Figure 5.

![Cause and Effect Diagram](image)

**Figure 5: Cause and Effect Diagram, Wartsila Zambia**

### 4.5 Analyzing Key Areas

Responses and data gathered from the questionnaire were brainstormed and analyzed. These gave a better understanding of the root causes and which area needs to be prioritized in order to achieve operational excellence. The key areas under investigation were categorized into five sections (people, process, equipment, environment and management) to identify which aspect needs to be improved in order to ensure an increase in organizational performance. The results from analyzing key areas is presented in the sections below.
4.5.1 People

The research questionnaire under this category sought to find out which areas needed to be addressed in order to bring out the best out of the employees. Results are presented in table 2 below.

Table 2: Analysis of Employee Performance Problems

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees need words of motivation from superiors</td>
<td>17</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.33</td>
<td>21</td>
</tr>
<tr>
<td>Employees need threatening words of dismissal for underperformance</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>10</td>
<td>3.52</td>
<td>21</td>
</tr>
<tr>
<td>Employees need weekly/monthly evaluation</td>
<td>2</td>
<td>14</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>2.14</td>
<td>21</td>
</tr>
<tr>
<td>Employees need individual coaching from their superiors</td>
<td>7</td>
<td>11</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1.81</td>
<td>21</td>
</tr>
<tr>
<td>Improvement in salary</td>
<td>15</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.29</td>
<td>21</td>
</tr>
</tbody>
</table>

In the key area of people, the key problem was improvement of salary, with a mean of 1.29. All the respondents agreed that this was a major concern, with 71.4% strongly agreeing and 28.6% agreeing. This is followed by employees needing word of motivation from superiors, with a mean of 1.33. In this case 81.0% of respondents strongly agreed, 9.5% agreed, and 4.8% disagreed whilst another 4.8% strongly disagreed. Next problem was employee needing individual coaching from their superiors, with a mean of 1.81. In this instance 33.3% of respondents strongly agreed, 52.4% agreed and 14.3% disagreed. Next on the scale of people problems was employees needing weekly/monthly evaluation with a mean of 2.14 and with 9.5% strongly agreeing, 66.7% agreeing and 23.8% disagreeing. Last on the list of people issues was employees needing threatening words of dismissal for underperformance with a mean of 3.52 and 47.6% strongly disagreeing, 33.3% disagreeing, 4.8% agreeing and 4.8% strongly agreeing. Figure 6 presents the percentage frequency of responses on people issues.
4.5.2 Working Process

The research questionnaire under this category was to find out if working ethics and the right working process are being practiced in order to help improve employees’ performance. Figure 7 below shows the number of respondents under each question.

**Table 3: Analysis of Working Process Problems**

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation of working procedure</td>
<td>9</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.81</td>
<td>21</td>
</tr>
<tr>
<td>Coordination among team members</td>
<td>8</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1.67</td>
<td>21</td>
</tr>
<tr>
<td>Getting the necessary training from current superior</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>5</td>
<td>2.48</td>
<td>21</td>
</tr>
<tr>
<td>Three months of rotational working shifts</td>
<td>1</td>
<td>18</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2.05</td>
<td>21</td>
</tr>
<tr>
<td>Superior impatient to subordinate when a problem arises</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>2.90</td>
<td>21</td>
</tr>
</tbody>
</table>
The key problem identified under work process was coordination among team members with a mean of 1.67. For this issue 57.1% of respondents agreed that coordination among team members is one of the factors affecting performance. 38.1% of respondents also strongly agreed with the statement. Whereas 4.8% respondent disagreed with the statement.

This was followed by documentation of working procedure with a mean of 1.81. Out of the total number of 21 respondents, 47.6% respondents agreed that, working or training procedure should be documented and made accessible to employees. 42.9 of the respondents strongly agreed to this statement while 4.8% respondents strongly disagreed and another 4.8% neither agreed nor disagreed with the statement.
Next was Three months of rotational working shifts with a mean of 2.05. Out of the total of 21 respondents 85.7% of respondents agreed that three month of rotational working shift affect their performance improvement. 4.8% strongly agreed, whereas 9.5% respondents disagreed. This is followed by getting the necessary training from current superior, with a mean of 2.48. In this case 28.6% respondents strongly agreed that they are getting the necessary training from their superior whereas 19% respondents also agreed to the statement. On the other hand, 28.6% of respondents disagreed to this statement, whereas 23.8% of respondents also strongly disagreed.

The last issue under work process was superior impatient to subordinate when a problem arises with a mean of 2.90. Total of 52.4% respondents strongly disagreed that superiors’ are impatient to subordinate when a problem arises and 4.8% of respondents seconded to this statement by disagreeing. On the other hand, 23.8% respondents agreed that superiors are impatient when problem arises and 19% of respondents strongly agreed to support the statement.

4.5.3 Machine and Equipment

The questions under this section was to find out which areas needed to be addressed in order to find out what to change or issues to address regarding machine and equipment. Figure 8 below shows the percentage frequency of responses under each question and table 4 presents frequencies of responses.

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating the actual knowledge of individual for working principle of each equipment.</td>
<td>6</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.95</td>
<td>21</td>
</tr>
<tr>
<td>Blaming an employee on a first mistake done on operating an equipment</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>12</td>
<td>3.38</td>
<td>21</td>
</tr>
<tr>
<td>Continuous In-house training on equipment and machines.</td>
<td>11</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1.67</td>
<td>21</td>
</tr>
</tbody>
</table>
The key problem with regards to machine and equipment at the company was Continuous In-house training on equipment and machines with a mean of 1.67. The results from the study indicated that 52.4% of the total respondents strongly agreed that continuous in-house training on equipment and machines would improve performance. 38.1% of respondents also agreed to the statement and 4.8% of the respondent disagreed with the statement. The second ranked issue was evaluating the actual knowledge of individual for working principle of each equipment with a mean of 1.95. The results from the study as shown in figure 8 indicates that 61.9% of respondents agreed that evaluating actual knowledge of employee on working principle of equipment will improve performance. 28.6% of respondents also strongly agreed to the statement whereas 4.8% of the respondents strongly disagreed and finally 4.8% respondents neither agreed nor disagreed.

Figure 8: Analysis of Machine and Equipment Problems
The third ranked issue was blaming an employee on a first mistake done on operating an equipment with a mean of 3.38. Total of 57.1% of respondents strongly disagreed that blaming employee on a first mistake done on operating an equipment is a way to improve performance. 33.3% of respondents also disagreed with the statement and 4.8% of respondents strongly agreed that blaming employee on a first mistake done operating an equipment is the way to improve performance.

4.5.4 Environment

One of the things which most organizations fail to understand is the impact of working environment to employee satisfaction and performance and this leads to a lot of difficulties during their work. Working environment could be categorized into two main streams of work and context. Work includes all the different characteristics that the job entails, carried out and completed. It is therefore paramount to ensure that the environment in which all works are carried out meet the required standard. The research questionnaires under this section sought to find out what needed to be addressed regarding the work environment. Figure 9 below shows the percentage frequency of responses under each question.

Table 5 Analysis of Working Environment Problems

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise and vibrations around affect performance indirectly</td>
<td>12</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1.81</td>
<td>21</td>
</tr>
<tr>
<td>Working hours is very long/tiresome</td>
<td>7</td>
<td>10</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1.90</td>
<td>21</td>
</tr>
<tr>
<td>Control room is not conducive or standard to work in</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>3.19</td>
<td>21</td>
</tr>
<tr>
<td>Harassment from colleagues or management</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>7</td>
<td>2.95</td>
<td>21</td>
</tr>
</tbody>
</table>
The number one ranked problem with regards to work environment was Noise and vibrations around affecting performance indirectly with a mean of 1.81. From the above figure, results show that 57.1% of the respondents strongly agreed that vibration and noise affect their performance and 23.8% of respondents agreed with the statement. 9.5% of the respondents were not sure neither to agreed nor disagreed and another 9.5% disagreed.

The next ranked issue was working hours is very long/tiresome with a mean of 1.90. From the above figure, results indicate that 33.3% of respondents strongly agreed and 23.8% of respondents also agreed that working hours is very long. 4.8% respondents strongly disagreed to the statement and 14.3% of respondents also disagreed.

Harassment from colleagues or management followed with a mean of 2.95 as the next ranked work environment problem. From the above figure, the scores under this question are distributed as 33.3% of respondents strongly disagreed and also 28.6% of
respondents disagreed that harassment from colleagues or management affect their performance. Whereas on the hand 14.3% and 19% of respondents strongly agreed and agreed respectively to the statement, while 4.8% of respondents neither agreed nor disagreed to the statement.

The least ranked issue was control room is not conducive or standard to work in with a mean of 3.19. From the above figure, the results from the research question under this section shows that 42.9% of the respondents disagreed that control room is not standard or conducive to work in and 19% of respondents also back the statement by strongly disagreeing. On the other hand, 19% of respondents agreed and 4.8% of respondents also strongly agreed to the statement. Meanwhile 14.3% of respondents were not really sure whether to agree or disagree.

The results indicate that, the two questions, control room not conducive or standard to work in and harassment from colleagues or management cannot be considered as reasons of the causes of slow progress of employees under environment as majority of employee disagreed that they are contributing factors to their performance.

4.5.5 Management

One of the principles of quality improvements is involvement of management in issues pertaining to quality work. It is an effective way to ensure that the quality of work within any given organization is kept to the standard (Oakland, 2015). The research questionnaires under this section is to find out what needs to be addressed regarding management involvement to performance improvements. Table 6, below shows the frequency of responses under each question and the mean.
Table 6 Analysis of Management Problems

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentives from management</td>
<td>12</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1.48</td>
<td>21</td>
</tr>
<tr>
<td>Management needs to quickly address issues in a standard way</td>
<td>14</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.43</td>
<td>21</td>
</tr>
<tr>
<td>Communicating clear goals and expectations to employees</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1.43</td>
<td>21</td>
</tr>
<tr>
<td>Monthly face to face meeting with management to discuss disturbing issues</td>
<td>14</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1.38</td>
<td>21</td>
</tr>
<tr>
<td>Preferences of some employees over others</td>
<td>13</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1.52</td>
<td>21</td>
</tr>
<tr>
<td>Organizational leaderships</td>
<td>9</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1.71</td>
<td>21</td>
</tr>
<tr>
<td>Poor selection or pairing of team</td>
<td>9</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1.71</td>
<td>21</td>
</tr>
</tbody>
</table>

The first ranked management problem was Monthly face to face meeting with management to discuss disturbing issues with a mean of 1.38. With regards to this question shown on figure 10, 66.7% out of the total respondents strongly agreed that meeting with the managers should be held in every month. 28.6% of the respondents also agreed to the statement whiles 4.8% of respondents disagreed.

The second ranked issue was management needing to quickly address issues in a standard way with a mean of 1.43. Out of the total of 21 respondents, 66.7% respondents strongly agreed that management quickly addressing issues in a professional way would help improve performance. In addition, 28.6% of respondents also agreed to that statement. However, 4.8% of respondents strongly disagreed that management addressing issues in a standard manner is not a problem to employees’ performance.

Next issue was communicating clear goals and expectations to employees with a mean of 1.43. From figure 10 below, 61.9% of the respondents strongly agreed that goals and expectations are not clearly communicated to the employees and 33.3% of the respondents
also agreed to the statement. Only 4.8% of respondents disagreed to the statement, if goals and expectations are communicated to them clearly it would have help them improve their performance. Failing to make expectations clear can frustrate employees and hinders their ability to successfully complete a task. It also depends on employees understanding on how their work aligns with the organisations mission and business goal. For example, what do you do? It’s a simple question, but one that many employees can’t easily answer.

The fourth ranked management issue was incentives from management with a mean of 1.48. Out of the total of 21 respondents, 57.1% of respondents strongly agreed and 38.1% of respondents also agreed that incentive from management is a motivational factor for improving performance. Only 4.8% respondent disagreed with the statement. Incentives are a motivational way of improving performance. This is not really regarded as one of the reasons for causes of slow progress of employee but a way of improving their enthusiasm towards work An effective reward system helps an organisation to be more competitive, retains key employees performing very well and such reward system should relate to the employees productivity. Furthermore, efficient reward system can be a good motivator. Incentives to motivate employees can be in many forms such as: awarding an employee a gift as best or hard working employee of the month, seeing and clearing danger on the way, providing lunch to all as some work on empty stomach, and etc.

The fifth ranked management issue was preferences of some employees over others with a mean of 1.52. From figure 10 below 61.9% and 33.3% respondents strongly agreed and agreed respectively that preferences of some employees over the other is one of the big problem affecting employees performance. One of the reasons of the causes of slow progress of employees is showing or letting other employees know you prefer these people to those. In an organisation where a leader shows preference over others leads to a big catastrophe. Example to this kind of situation was during the time of promotion where some were promoted without any selection criteria system and some of them are under performing.
With a mean of 1.71, the sixth ranked management issue was organizational leaderships. 42.9% of total respondents strongly agreed that organizational leaderships is another issue to tackle and 52.4% of the respondents also agreed to the statement. 4.8% of respondents neither disagreed nor agreed to the above statement. Organizational leadership is said to focus on managing what is best for individuals and a group as a whole and also a work
ethic that empowers individual to lead from top to bottom of an organisation. General Electric Cooperation defined a leader “as someone with vision and ability to articulate that vision to the team, so vividly and powerfully that it becomes their vision”. A leader should lead, guide, encourage, motivate, instil believes in his/her employees and advice towards situations.

The least ranked management issue was poor selection or pairing of team with a mean of 1.71. From figure 10 above, it is shows that 42.9% out of the total respondents strongly agreed that wrong pairing of the team members is a problem to performance improvement. 52.4% of the respondents also agreed to this statement whereas 4.8% respondent neither disagreed nor agreed to the same statement.

### 4.6 Improve Stage

Analysis of the data provided a great opportunity to better define the most needed areas to be improved. This phase provided a detail explanation of the root causes of the problem and what the implications of the responses from the study actually means. This phase also gave an overview of which areas need to be addressed and also an insight to suggest improvement solutions. Solutions are proffered to all issues based on their mean rankings. This is presented in table below. Each root cause is revised to bring about improvement in performance.
Table 7: Proposed Improvements and Monitoring

<table>
<thead>
<tr>
<th>Key Areas</th>
<th>Performance Improvement Areas</th>
<th>Performance Issues Ranked by Mean Scores</th>
<th>Proposed Improvements and Solutions</th>
<th>How to sustain improvements to ensure continuous improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Very low salary as compared to other departments with the same qualifications, moreover this department works in the night and during the weekends.</td>
<td>Adjustment of the salary can be done to bridge the gap with other departments. Individual salaries should be kept secret as revealing salaries causes more chaos among employees. Further investigation should be done on how employees’ salaries escalate easily in the plant for others to feel very jealous. Providing lunch and dinner as some employees work on empty stomach for longer hours most especially on night duty. Other means of incentives could also be implemented. Superior or leaders are mentors or role models to their subordinates, a good leading example might change their attitudes towards work.</td>
<td>Set up a salary review committee to review salaries and salary structure at an agreed periodic intervals to ensure that salaries reflect changing economic conditions and structure is fair and equitable.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Lack of Motivational words from superiors’ speech hampers employees’ performance</td>
<td>Encouraging and speaking kind words to subordinates as leadership in an organization is mostly the ability to motivate people to perform their duties within scheduled time using encouraging words and motivational speech.</td>
<td>Reward mentors who are able to positively influence mentees to improve performance on a monthly basis</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Employees not getting the necessary coaching or training from their superiors.</td>
<td>In order to bring the best out of the employees, continuous coaching should be from the superiors. This would help eliminate minor errors and mistakes being committed by the employees. In a situation where the superior is also lacking then the next superior needs to come in for help. Superiors are leaders, an example and trainers to the lower employees, when they are less knowledgeable then the probability of misleading the team is very high.</td>
<td>Providing employees with the necessary and continues coaching from superiors and managers. There are several ways of coaching an individual in order to get the best out of them. Operations manager and the assistance should take the responsibility of coaching each person by first of all building a good relationship of mutual trust and being patient. Secondly, asking questions to</td>
<td></td>
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help get clear what they really want. Thirdly, giving chance for brainstorming potential ways to solve problems and encouraging each to generate lots of options without evaluating at first attempt. Lastly, acknowledging employees hard work, and their commitment to professional and personal growth. Designing a system or structure for awarding employees on good merits or performance, taking risks in solving critical works, best team with excellent performance, etc. will sustain performance improvement from weekly and monthly evaluations.

Institute a code of conduct for all workers especially in the area of communication and evaluate how everyone adheres to this code of conduct.

4. Employees need weekly/monthly evaluation

Would help boost their way of learning. In life some people are to be forced to read or learn whereas some are not. In order to improve employees performance weekly or monthly evaluation would pushed employees to learn and to be acquainted with the systems.

Employee who have serious performance issues should be put on special program to improve their performance. Employee must be made to feel that they have job security. Punish superiors who threaten employees

5. Threatening employees with words of dismissal for under performance

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Institute a code of conduct for all workers especially in the area of communication and evaluate how everyone adheres to this code of conduct.

Continuous rotation of players from one team to the other every month so every player would have a taste of each team and learn from others. For example, if a player works in a team for a month, then moved to a different team the next month. With this it is very easy to identify whether the employee is not willing to learn or is not getting necessary training.

Evaluate employee performance as they rotate among teams to see if improvements are happening.
to be controlled by superior.

2. Lack of documented procedure for working or training employees

All the training or working procedure must be documented and make accessible to all employees. A documented way of working or training employees will help improve performance as superior will know what and when to do and how to train his/her subordinate. Documented training file to indicate steps and process of training employees.

Evaluate the understanding of the employee after training and performance level.

3. Three months of rotational working shift is one of the main reasons of slow progress of employee performance under working process. The three working areas which are rotated under operations department are: the engine hall, control room and the auxiliary area. This result is also an indication that when one continues to work in the control room for three months, then to the next area for three months and then to the last area for three months. After nine months of rotation, the possibility of employee forgetting the activities in one particular area is very high.

Reducing of three month of rotational work to one month or rotating of employees from one area of work to the other on every rotational duty. For example if one operator works as a control room operator in a weekly shift or a month, he should be moved to auxiliary or engine area for the next rotational duty or month. Again, the solution to this problem is rotation of employees or supervisors from one shift to the other so they can learn from each other and other superiors.

Evaluate performance of employee under reduced rotational system.

4. Not getting the necessary training from current superior, problem of lack of documented training manual as some superiors wouldn’t know what and how to train their subordinate.

Same as issue 2 above

Evaluate the understanding of the employee after training and performance level.

5. Superior being impatient with subordinate when a problem arises.

Superiors and subordinates are to be advice to be very patient with each other in times of difficulties or challenges.

Evaluate how employee handle difficult challenges and how it affect their performance. Mentoring system should help superiors deal
Key Areas
Performance Improvement Areas

Performance Issues Ranked by Mean Scores

1. Employees are not getting enough in-house training on machine and equipment to help them improve on their performance or they are seeking for more in-house continuous training.

Proposed Improvements and Solutions

A proposed in-house training on machine and equipment for each team once every month from the operations manager or the assistance. Training should be given on a particular system, unit, equipment or any challenges faced by one team every week.

How to sustain improvements to ensure continuous improvement

Evaluate progress of teams and team members in the knowledge and skills in the operation of machines and equipment

2. Less frequent evaluating of the actual knowledge of individual on working principle of each equipment. Although there is a middle of the year and end of the year evaluation for each employee which few hardly meet set target under the said department.

Proposed Improvements and Solutions

Continuous monthly evaluation will aid in improving the performance of the employee. In addition to the mid-year and end of the year evaluation, monthly evaluation on a trained unit, system, equipment or any challenges faced by one team should be conducted both on theoretical level and practical demonstration by each trained employee.

How to sustain improvements to ensure continuous improvement

Team and team member evaluations and implementation of results will sustain this improvement

3. Blaming employees on their first mistake on operating a machine does not help solve the problem of improving performance.

Proposed Improvements and Solutions

Recommending retraining

How to sustain improvements to ensure continuous improvement

Documenting mistakes and rewarding employees who make less mistakes will lead to improve performance and less blaming.

Key Areas
Performance Improvement Areas

Performance Issues Ranked by Mean Scores

1. Vibrations and noise around have a negative effect on individual performance. Most of the employees complain of continuous feeling of the vibrations and the noise in their hearings even after working hours in

Proposed Improvements and Solutions

The owner (NECL) has been working on to reduce. Management needs to continue pushing the owners of the plant to improve on the level of noise and vibrations. This can be achieved by raising this issue in every meeting with the customer as a reminder. Again, working hours in each shift can be reduced to 8 hours, three shifts in a day and total of 40 working hours in each week or rotation

How to sustain improvements to ensure continuous improvement

Evaluate noise and vibration levels at specific intervals to make sure they are with safety and acceptable levels
their various homes. The vibrations on site are beyond normal standard level

2. Long hours of working is very tiresome and they still feel the stress impact on them during off days. With the accumulation of environmental stress and long hours of work, there is a possibility of internal stress.

A propose working hours of 8 with three shifts rotation in a day unlike the current practice of 12 hours and 2 shifts in a day will be very good. For example, Team A works from 06:00hrs to 14:00hrs, Team B works from 14:00hrs to 22:00hrs, Team C works from 22:00hrs to 06:00hrs and Team D will be on off duty resting. This cycle of rotation continues as every team would work in all the working hours. This would help employees to reduce the number of hours being exposed to the vibration and noise around.

Evaluate performance under new working hours system

<table>
<thead>
<tr>
<th>Key Areas</th>
<th>Performance Issues Ranked by Mean Scores</th>
<th>Proposed Improvements and Solutions</th>
<th>How to sustain improvements to ensure continuous improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>Lack of Monthly face to face meeting with management to discuss disturbing issues. Meeting with the management at least once a month to discuss their concern and getting responds.</td>
<td>General meeting involving all employees should be conducted at least once a month to discuss concerns and getting responses. Alternatively, placing a suggestion box at a convenient place for employees to drop their suggestions or problems. This would also help in motivating them and improving on their performance.</td>
<td>Evaluate effect of frequent general meetings on performance of teams and individual team members. Publishing implementation plans for issues raised</td>
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<tr>
<td></td>
<td>Management needs to quickly address issues in a professional manner. There are times management does not handle issues of individual employee in a way it supposed to be managed but rather make it publicly to be known by everyone.</td>
<td>A good leadership skill should be exemplified by the management. For example, showing sign of coordination and corporation among themselves, keeping issues of employees between the employees and the management and supporting them with guidance and encouragement.</td>
<td>Open door policy by management will sustain open resolution of issues and continuous improvement in performance</td>
</tr>
<tr>
<td></td>
<td>Not communicating clear goals and expectations to employees. More is expected from the employees yet less is communicated to them.</td>
<td>Communicating clear goals and expectations to the employees. Managers should take the opportunity to have one on one meetings to discuss how each individual or team member contributes to the company mission. Work together to set individual metrics and goals that align with the business priorities</td>
<td>Use of dashboards to evaluate real time performance will help sustain improvement brought about by clearly defined and communicated goals</td>
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</table>
as a whole. When each person knows how their effort impacts the bottom line, they will take more ownership and have greater motivation to do their best work.

4. getting incentives from the management

A leader should possess impartiality action-oriented approach and positive attitude. A good leader should always show impartial attitude towards all his followers. The moment he becomes partial, he loses the confidence of others and reduces the respect of leading. For example, promoting employees based on performance, justification and merits instead of likeness. When employees are promoted based on promotional criteria, they do get full support from other colleagues. A promotional criteria system like interview or a test can be designed for promotional purpose and the best should be given the opportunity.

5. preferences of some employees over others

Players should be rotated from one team to the other, knowing the strength and weakness of players being paired and accepting complaints of players not willing to work with a particular person or team. For example, a player from team A can be moved to team B and vice versa. Providing managers and team leaders with a leadership training and to be advised to implement training given without applying any personal prejudice.

6. Poor selection or wrong pairing of the team

Reshuffling of organizational leaders could also be a possible solution. Leaders could be moved from one branch of the company to another branch in a durational schedule.
4.7 Control Stage

A recommendation on how the entire process can be controlled was given in order to ensure that this is not just a onetime study but a continuous process and it could be implemented in other Wartsila departments or branches. The SIX SIGMA is a closed loop and a continuous process therefore any study based on this principle should be a continuous process. Details of control recommendations assigned to each ranked root cause are shown in table above. It based on the actions to be taken to sustain the gains and measures to verify improvement will take place as a result of implementation of improvements by Wartsila Zambia.
5 RESULTS DISCUSSIONS

This study set out to investigate the main causes of employee performance problems at Wartsila Zambia using SIX SIGMA-DMAIC analysis with aim of making recommendations that will lead to improved employee performance and organizational productivity as well as serving as a framework for implementing continuous improvement at the organization. The DMAIC analyses results indicate that there are serious people, work process, machine and equipment, environment and managements issues at the target company. It also provided a platform for the improvement, monitoring and sustaining suggested improvements that leads to better performance.

The issues were multi-faceted and each key area had more than one issue. In the Improve stage they were prioritized using the mean of responses given by employees of the target company. The key issues for each area based on the ranking were:

- Employees not getting enough in-house training on machine and equipment to help them improve on their performance.
- No coordination among team members
- Non conducive work environment, characterised by vibrations and noise in the work environment
- Lack of monthly face to face meeting with managements to discuss disturbing issues.
- Low pay for local employees and non-equitable pay structure.

In prioritizing the issues, the improvements were also prioritized to ensure that solutions will lead to performance improvements in the company.

This is in line with revelations produced by other SIX SIGMA- DMAIC analysis projects. Liu et, al. (2013) applied SIX SIGMA-DMAIC analysis to investigate performance management problems in DL Motorola in China. The study revealed that performance management was an important part of the company but was a time consuming process and this prevented employees and management from taking it serious which in turn led to low performance of the workforce. Root cause analysis using Voice Of the Customer (VOC) in
this case employees and presented in a fishbone diagram, showed that there were no batch sign in for employees in the performance management system, HR needed a lot of time to synchronize employees’ ID for them to commence and sign into the performance management system and managers needed a lot of time to dialogue with employees when performing the performance management processes. The improvement solution was to look for ways to make the process faster and cost saving. Solutions were proffered and tested by a pilot quality team. The test showed that improvements actually shortened the time of the process and also brought about cost savings.

This study has proffered solutions that will improve employee performance and the productivity of Wartsila Zambia and also serve as a template for other Wartsila branches across the world.
6 CONCLUSIONS AND RECOMMENDATIONS

This study set out to investigate the main causes of employee performance problems at Wartsila Zambia using SIX SIGMA-DMAIC analysis with aim of making recommendations that will lead to improved employee performance and organizational productivity as well as serving as a framework for implementing continuous improvement at the organization. Employees’ performance can be turned around if some of these proposed solutions are given attention. As said in the previous chapter, answers to the reasons for the causes of slow progress are arranged according to the degree of response from the questionnaire.

Considering the importance of quality and continuous improvement in any given organization and the sensitivity of the nature of the work carried out by the department under study, it is therefore important that the areas that have been reviewed or studied should be given much attention. To this effect, certain recommendations have been made after a careful analysis of the results and discussions to find out how the department can implement changes to improve upon the quality of services in the department.

Involvement of management in continuous improvement should be put as the main priority in achieving the best out of any employee. It was very clear from the results that all the response from the questionnaire under management were of “highly agreed” or “agreed”, which indicate the impact of management role on employees’ progress.

The main purpose of the SIX SIGMA methodology is not only improving the process performance but also sustaining the improved results in a long run. Having identified the causes of the problem and the possible solutions to reduce the problem. It was recommended to effectively implement and put in practice all suggested solutions so that the improvement will be realized, and to continue to seek out additional improvement potential. Priority areas in implementation should be for the ranking of the problems identified.

1. 8 working hours with three shifts rotation in a day and rotation of workers from one team to another.
2. Meeting with the management at least once a month to discuss concerns and getting responds or alternatively, placing a suggestion box at a convenient place for employees to drop their suggestions or problems.
3. A documented procedure for working and training employees.
4. Adjustment of salary

Wartsila Zambia needs to put in place a quality and performance improvement team to monitor and sustain improvements.

Lastly management should invest in the use of people and process-related dashboards to measure performance as an essential element in creating a SIX SIGMA culture of continuous improvement.

6.1 Limitations

Study looked at process and people within Wartsila Zambia. This is a limitation as external influences of suppliers and customers may also have an effect on quality and staff performance issues.

The study also did not delve into training of workers in six sigma to ignite their interest in quality improvements and Wartsila Zambia commitment to high quality standards.

Another critical limitation was the time used to conduct the research. The period was so short it did not give the researcher the opportunity to observe the post implementation phase to see if proposed solutions were working the adjustments that needed to be made as well as measuring the level of involvement of employees and management to the success of the initiative.
7 SUMMARY AND FURTHER RESEARCH

7.1 Summary
This study sought to improve employee performance at Wartsila Zambia using DMAIC analysis to find out the causes of slow progress of employee performance with aim of making recommendations that will lead to improved employee performance and organizational productivity as well as serving as a framework for implementing continuous improvement at the organization. To achieve these objectives the following questions were asked: What are the causes of slow progress of employees’ performance at Wartsila Zambia? What are the reasons for the causes of slow progress of employees’ performance at Wartsila Zambia? And How to improve employees’ performance Wartsila Zambia? The study revealed that the min causes for the slow progress of response at Wartsila Zambia were as follows:

- Non equitable pay structure and low pay for local workers
- Employees not getting enough in-house training on machine and equipment to help them improve on their performance.
- No coordination among team members
- Non conducive work environment, characterised by vibrations and noise in the work environment
- Lack of Monthly meeting with management to discuss disturbing issues.

The reasons for these problem were because there were no proper coordination between management and workers, there was no quality and performance improvement team in place to evaluate performance both at individual and team level and finally work planning was poorly done.

After ranking the issues based on the means of responses from respondents, solutions and monitoring programs were recommended to improve performance at Wartsila Zambia. The solutions included
1. Adjustment of salary of locals and putting in place equitable pay structure. To sustain this it was suggested that a team should be put in place to review salaries at agreed time intervals.

2. Meeting with the management at least once a month to discuss concerns and getting responds or alternatively, placing a suggestion box at a convenient place for employees to drop their suggestions or problems. To monitor and sustain this management was tasked to evaluate effect of frequent general meetings on performance of teams and individual team members and Publish implementation plans for issues raised.

3. A documented procedure for working and training employees. Conduct in-house training on machine and equipment for each team once every month from the operations manager or the assistance. This training should be given on a particular system, unit, equipment or any challenges faced by one team every week. To sustain this management must evaluate the understanding of the employee after training and performance level and progress of teams and team members in the knowledge and skills in the operation of machines and equipment.

4. Creating a conducive work environment by reducing noise and vibration levels at the work place and to continually evaluate noise and vibration levels at specific intervals to make sure they are with safety and acceptable levels.

5. Change work hours to 8 working hours with three shifts rotation in a day and rotation of players from one team to another.

7.2 Suggestions for Further Research

This study has applied SIX SIGMA-DMAIC analysis to people and process issues in a company with aim of improving performance and productivity at Wartsila Zambia, further research should be carried to find out how successful this improvement project has been for Wartsila Zambia. Also studies can be done to find the strength of relationships between continuous improvement initiatives like SIX SIGMA and employee performance as relationship with process optimization and improvement has been the focus of most of these initiatives.
8 REFERENCES


APPENDICES

Appendix 1: Questionnaire

OULUN YLIOPISTO
Industrial Engineering and Management
555300S Master’s Thesis

IMPROVING EMPLOYEE PERFORMANCE THROUGH QUALITY IMPROVEMENT INITIATIVES- DMAIC ANALYSIS OF WARTSILA ZAMBIA

Työn tekijä                Mubarak Issah
Opiskelijanumero 2417811    
Työn tarkastaja            Harri Haapasalo
I am Mubarak Issah, offering Masters in Engineering (MEng) in Industrial Engineering and Management at the University of Oulu. I am currently working on my final thesis on the topic “Improving employee performance through quality improvement initiatives - DMAIC analysis of Wartsila Zambia”

The aim of the study is to find out which areas need to be addressed in order to improve employee performance under Operation department.

The SIX SIGMA has five steps; define, measure, analyze, improve and control. By answering the questions below, it would help measure and analyze the areas which need to be improved in order to upgrade the quality of service provided to the customer.

**Section A:** BIOGRAPHIC DATA

1. Sex  
   - Male □  
   - Female □

2. Department

3. Position/Rank

4. How long have you been working with the organization? .................

**Section B:** Please answer the following question by circling either 1,2,3,4 or 5.

1: Strongly agree  2: Agree  3: Strongly disagree 4: Disagree 5: Neither agree nor disagree

1. **With regards to employees which of the following needs to be addressed in order to improve employee’s performance.**
   A. Employees need words of motivation or performance appraisal from management or superiors.
      
      1  2  3  4  5

   B. Employees need threatening words of dismissal for underperformance.
      
      1  2  3  4  5

   C. Employees need weekly/monthly evaluation.
D. Employees need individual coaching from their superiors.

E. Improvement on salary

2. With regards to working process which of the following needs to be addressed to improve performance.

A. Working/training procedure should be documented and make accessible to employees.

B. Coordination among team members

C. Getting the necessary training from current superior.

D. Three months of rotational working shifts

E. Superior impatience to subordinate when problem arises.

3. With regards to machine and equipment which of the following needs to be addressed and improved on.

A. Evaluating the actual knowledge of individual for working principle of each equipment.

B. Blaming employee on a first mistake done on operating an equipment.

C. Continuous In-house training on equipment and machines.
4. With regards to environment which of the following needs to be addressed to improve performance.
   A. Noise and vibrations around affect performance indirectly.  
      1  2  3  4  5  
   B. Working hours is very long/tiresome.  
      1  2  3  4  5  
   C. Control room is not conducive or standard to work in.  
      1  2  3  4  5  
   D. Harassment from colleagues or management.  
      1  2  4  5

5. With regards to management which of the following needs to be addressed to improve performance.
   A. Incentives from management  
      1  2  3  4  5  
   B. Management needs to quickly address issues in a professional or standard way.  
      1  2  3  4  5  
   C. Communicating clear goals and expectations to employees  
      1  2  3  4  5  
   D. Monthly face to face meeting with management to discuss disturbing issues  
      1  2  3  4  5  
   E. Preferences of some employees over others  
      1  2  3  4  5  
   F. Organizational leaderships  
      1  2  3  4  5  
   G. Poor selection or wrong pairing of team  
      1  2  3  4  5