Economic Implications of Statistical Quality Control: Lessons for Manufacturers in Nigeria

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Abstract: This study examined the economic implications of statistical quality control. It applied the literature study method. The study highlights the methods of statistical quality control as well as the economic benefits derivable from the use of and adherence to the processes of quality control in general and scientific and statistical quality control in particular. Quality consciousness, consumers' satisfaction, cost reduction and optimum utilization of resources are some of the numerous economic benefits of scientific and statistical quality control. While wastages, decrease in sales and decrease in profitability are some adverse economic implementations of the absence of or neglect to use statistical quality control in an organization. The campaign for quality assurance should be driven to the grass root for all and sundry, especially the manufacturing sector, to become conversant with the need for quality products, services and results delivery. This will make their product compete favourably with foreign products.

Keywords: Quality, Quality Control, Economic Benefits and Economic Implications

1. Introduction

The demand for quality has taken a scientific dimension, which is different from what obtained in the past. This has forced organizations to imbibe the culture of shape in or fall out. The need and desire for quality products cuts across individuals, groups, organizations and nations at large. A quality product is preferable to an inferior product. That quality products are the delight of the rational man cannot be over emphasized. This is evident in the way Nigerians go for foreign goods and service and in their patronage of Foreign Service providers.

Scientific or Statistical Quality Control (SQC) refers to the use of statistical methods in monitoring and maintaining the quality and standard of products, services and results emanating from an organization. Statistical quality control is the term used to describe the set of statistical tools used by quality professionals to analyze the quality problems of organizations and to solve such problems [1]. Quality Control has been with us for a long time. It is safe to say that when manufacturing began and competition accompanied manufacturing, consumers would compare and choose the most attractive of the available product, services or results [2]

Improvement of quality did not necessarily stop with the product, service or result, but also included the process used in making the product, service or result. The process was held in high esteem, as manifested by the medieval guilds of the middle ages. These guilds mandated long periods of training for apprentices, and those who were aiming to become master craftsmen had to demonstrate evidence of their ability. Such procedures were, in general, aimed at the maintenance and improvement of the quality of the process.

In modern times we have professional societies, governmental regulatory bodies such as the National Agency for Food and Drug Administration and Control (NAFDAC) in Nigeria, factory inspection, aimed at assuring the quality of products sold to consumers. Quality Control has thus had a long history. On the other hand statistical quality control is comparatively new. The science of statistics itself goes back

only two to three centuries. And its greatest developments have taken place during the twentieth century. The earlier applications were made in astronomy and physics and in the biological and social sciences. It was not until the 1920's that statistical theory began to be applied effectively to quality control as a result of the development of sampling theory. Shewhart [3] was the first to apply the newly discovered statistical methods to the problem of quality control.

Quality Control is used in all phases of business but is extremely relevant in engineering and manufacturing in developing systems to ensure standard in products or services. Quality control is used to meet or exceed customer requirements and is vital in the manufacturing part of businesses.

2. Statistical Quality Control (SQC)

Quality control generally is the process of inspecting products to ensure that they meet the required quality standards. This method checks the quality of completed products for faults. Quality inspectors measure or test every product, samples from each batch, or random samples as appropriate to the kind of product produced, services rendered or results presented. Statistical Quality Control refers to the use of statistical methods in the monitoring and maintaining of the quality and standard of products, services and results. Statistical quality control is the term used to describe the set of statistical tools used by quality professionals to analyze the quality problems of organizations and to solve them [4 – 5].

The core objective of quality control is to ensure that the business is achieving the standards it sets for itself as well as the generally acceptable standard in the industry. In most every business operations, achieving perfection usually is impossible, as there will always be some variation in terms of materials used, production skills applied, and or the reliability of the finished products. Adherence to quality control processes protect against accidents and financial loss. Statistical quality control involves setting standards about how much variation is acceptable. The aim is to ensure that a product is manufactured, or a service is provided, or a result is achieved to meet the specifications which ensure customer needs are met [6].

3. Statistical Quality Control Techniques

There are several methods of statistical quality control. At its simplest, quality control is achieved through inspection. For example, in a manufacturing business, trained inspectors examine samples of work-in-progress and finished goods to ensure standards are being met or achieved. There are very important techniques of applying statistical quality control. These techniques or methods are as listed below [5, 7].

Quality Control Charts: A quality control chart is a graphic presentation of the expected variations in quality. Certain assumptions are taken into consideration before drawing these charts. For example, inherent nature of certain variables in a product, tolerance limits and probability of chance in variations are given adequate attention. Tolerance limits are clearly shown by these charts with regard to a particular product. Variations in quality beyond these limits clearly disclose that the production process is out of control and the quality of the product has not been achieved in accordance with the predetermined standards.

On the other hand, a process is said to be in control if the finished product remains within the tolerance limits. Quality control charts are very helpful in spotting the causes responsible for variations from the set standards on the basis of information disclosed by these charts. Different types of quality control charts may be used for recording different types of analysis. Some of the important quality control charts are chart of averages and that of range. Information disclosed by these charts is very accurate and authentic [8 – 11].

Acceptance Sampling: This is another technique of statistical quality control. This is also referred to as Sampling Inspection Plan (SIP). This method is usually followed after goods have been produced or are in the final stage of production. Thus, it can be said that it is a post mortem of the quality of the product that has already been produced. Under this method, a sample of the product produced is selected at random to study in detail whether the product conforms to the pre-determined standards or not. A limited percentage of defective products are allowed [12 – 15].

But it has been observed that sometimes the sample selected turns out to be good, but the lot represented by the sample may be defective or sub-standard. In order to have more accurate and exact results, more than one sample of the product should be selected for carrying out the Sampling Inspection Plan. The technique Acceptance Sampling undertakes two limiting levels of quality namely; [16 – 17]

(i) The Acceptable Quality Level: This is the least number or percentage of defective products that the buyer expects to purchase and the seller expects to sell.

(ii) The Lot Percentage Tolerance Defective: This refers to that limit where the buyer wants to be certain about the rejection of the lot.

This technique can be greatly helpful for improving relations between vendor and the customer which may be adverse on account of disputes relating to quality. Both parties may sit together and mutually decide the limits within which quality should be accepted.

Other statistical methods of quality control include;

Failure Testing: This method involves testing a product until it fails. It can be placed under different stresses such as humidity, vibration and temperature. This method will expose the weaknesses of the product and help to take corrective measure.

Statistical Control: Most manufacturing companies use statistical control in their operations and production processes. This process involves randomly sampling and testing a portion of the output to determine any fall in standard or loss of value.

Company Quality: This method allows the management to

lead the quality improvement process and other cadre and departments will then follow. This results in a successful product or service or result.

Total Quality Control: This is a measure used in cases where sales decrease despite implementation of statistical quality control techniques or quality improvements.

4. Benefits of Statistical Quality Control

Statistical Quality Control has health, social and economic benefits. Some of the numerous multi-dimensional and multi-purpose benefits of quality control include the following:

Quality consciousness: Quality control entrenches and encourages quality consciousness in the workers of the organization. This is greatly helpful in achieving desired level of quality in their products, services or results. The same is true of the customers that patronize the products, services and results of the firm.

Consumers' Satisfaction: Consumers are greatly benefited as they get better quality products, services or results on account of quality control. It gives them satisfaction and also a sense of esteem.

Reduces production cost: By undertaking effective inspection and control over production processes and operations, production costs are considerably reduced. Quality control further checks the production of inferior products and wastages thereby bringing down the cost of production considerably.

Effective utilization of resources: Quality control ensures optimum utilization of available resources and so minimizes wastage and inefficiency of every kind.

Reduces inspection cost: Quality control brings about economies of scale in production and inspection. It considerably reduces cost of inspection.

Increased goodwill: By producing better quality products and satisfying customers' needs, quality control raises the goodwill of the product and the organization in the minds of people. A reputed product or organization can easily raise finances from the market.

Boost employees' morale: An effective system of quality control is greatly helpful in boosting the morale of employees, and they feel that they are working in an organization that produces better and higher quality products.

Improve employer-employee relations: Quality control develops to better industrial atmosphere by increasing morale of employees which ensures cordial employer-employee relations leading to better understanding and closeness between them.

Improves production processes: By supplying technical and engineering data for the product and manufacturing processes, improved methods and designs of production are ensured by quality control.

Effective advertisement: Organizations producing quality products have effective advertisement. They win public confidence by supplying better quality products to the consumers.

Facilitate pricing: Appropriate quality control measures allow products of the same quality to be produced. This greatly facilitates the problem of price fixing. One price of standard products becomes prevalent in the market.

Increased sales: Quality control ensures production of quality products which is immensely helpful in attracting more customers for the product thereby increasing sales. It is greatly helpful in maintaining existing demand and creating new demand for the product. It has been rightly pointed out that quality control is a powerful instrument with the help of which markets both at home and abroad can be expanded [5].

5. Economic Implications of Statistical Quality Control

A cursory look at the foregoing clearly reveals that Statistical Quality Control has varying implications, amongst which are economic, social and health implications. The economic implications of statistical quality control are our concern in this study. When quality products are produced as a result of statistical quality control measures put in place in an organization, the following will be noticeable.

There will be considerable reduction in the cost of production. Undertaking effective inspection and control over production processes and operations will result in a considerable reduction in production costs. Reduction in production costs in turn results in savings of the organization's resources.

There will be reduction in wastages. Adequate quality control measures put in place will check the production of inferior goods. Inferior good leads to wastages while quality or superior goods result in less waste thereby saving organization's resources.

There will be optimum utilization of organizations resources. Proper quality control will ensures optimum utilization of organization's available resources. This minimizes wastage, inefficiency of varying kinds and savings of organization's scarce and limited resources.

There will be economies of scale. Quality control will brings about economies of scale in production and inspection, as it considerably reduces cost of inspection.

Organizations producing quality products will have effective advertisement that will win and capture public confidence by supplying better quality products to the customers. Appropriate quality control measures will ensure products of the same quality are produced at all times. Quality control will ensure production of quality products; this will in turn help in no small way in attracting more customers for the product thereby increasing sales. Quality control will helps in maintaining existing demand and creating new demand for the product. Quality control is a powerful instrument that will help to expand markets both at home and abroad. Expanded market leads to increased demands, sales and profitability.

Lack or absence of quality control, especially statistical quality control measures in place in an organization leads to

various problems. Some of such problems include the following;

It results in the production of sub-standard or inferior products. The probability of producing sub-standard and inferior products is very high when adequate and appropriate quality control measures are not in place.

It results in wastages and pilfering. Pilfering and wastages is high when there is absence of quality control measure in place in an organization.

Production of sub-standard or inferior good, pilfering and wastages results in increased cost of production, increase in material wastages and rejects, less utilization of organizations' resources, no economies of scale, decreased demand for organization's products, decreased sales and decreased profitability. All of these have varying but adverse effect on the organization and its resources.

6. Conclusion

Statistical quality control has varying economic implications. These implications have varying degree of impact and effects on the customers who are the end users of the products from these organizations. Individual organizations and the nation at large have their own share of these implications. Organizations which products are sub-standard and inferior would have less or no patronage for its outputs and hence is most likely to comatose or moribund in no distant time. If that happens the investment of the stakeholders would have gone down the drain. That would psychologically take its toll on the stakeholders. That will also affect their financial status as well.

Experience has shown that Nigerians prefer foreign products and services to locally manufactured products. This is partly because of the quality and superiority these products have over the locally and home made products. When we patronise foreign organizations by purchasing their products, we deplete our foreign reserve, give such organization better competitive advantage, reduce the demand and sales of our local manufacturers and also their profitability. The spiral effect of all of these are better imagined that experience.

When we put in place therefore and apply adequate and appropriate statistical quality control measures in the production and operation systems of our local industries and in the manufacture of our local and home made products, better quality and superior outputs will result. It will in turn result in savings, increased sales and higher profitability for the local and home based organization. It will reduce the appetite for foreign products amongst the citizenry.

Therefore, for the survival of our manufacturing industry, for the growth of our economy, for better customers' satisfaction and for competitive advantage for our manufacturers and their products in the global market, we cannot help but to imbibe the culture of quality consciousness and customers satisfaction through the use and application of quality and statistical quality control in the production and operation systems of our organizations. The campaign for quality assurance should be driven to the grass root for all and sundry to become conversant with the need for quality products, services and results delivery.

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