QUALITY MANAGEMENT AND TOOLS

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Foreword

Quality represents a contemporary discipline and ideology pursued by managers in their quest for excellence. It serves as a means to both attract customers and attain market leadership. While its prominence in today's business landscape may seem novel, the roots of quality consciousness trace back to earlier times, notably evident in the Japanese emphasis on meticulous craftsmanship. Additionally, the significance of quality finds acknowledgment in Islam, which perceives it as synonymous with perfection.

At its core, quality denotes the ability of a product to meet the discerning requirements of customers upon delivery. Defined by the European Organization for Quality Control, quality encompasses a spectrum of attributes that characterize a product's suitability in meeting customer needs. However, the conceptualization of quality varies widely, encompassing notions such as product value, alignment with customer expectations, and service excellence. Moreover, the perception of quality is shaped by the unique characteristics of companies, institutions, and the products or services they offer. Harvey and Green (1993) delineate five distinct interpretations of quality based on conceptual frameworks: exception, perfection, values, transformative, and purpose.

Quality exerts influence across various spheres, impacting stakeholders such as customers, employees, partners, and owners. Each stakeholder group perceives quality through its lens and defines it according to the outcomes it engenders. Furthermore, achieving a high-quality standard necessitates collaboration among all stakeholders. For instance, employees perceive quality through well-structured programs that facilitate their optimal performance, while any deficiency in quality can impede productivity. For customers, quality represents the assurance of receiving satisfactory service or acquiring superior products.

The book "Quality Management and Tools" is more than just a manual for becoming a success — it is a testament to the power of human ingenuity and the relentless pursuit of excellence. Issues in each chapter will witness the triumphs of those who dared to dream big and strive for greatness serving as a beacon of hope for future generations of innovators and leaders, therefore, it is important to read and make this book a part of every success achieved.

Author

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Chapter 1.
Quality Overview

A. Introduction

Quality is one of the modern sciences and philosophies that managers seek to achieve. It is a way to attract customers and achieve excellence and market leadership. The importance quality has achieved today is not a new innovation. Quality had appeared in the past when the Japanese were interested and gave attention and importance to quality and perfect work. In addition, Islam recognises the quality of work as quality indicates perfection.

Quality refers to the capacity of a product to be delivered in its final form that meets the customers' needs. As defined by the European Organisation for Quality Control, quality is a set of characteristics describing a specific product that determines its capabilities according to customers' needs. Quality is an art with many different conceptualisations. Some definitions relate to the value of the products, services, customer needs, and expectations. Furthermore, quality differs according to the nature of the companies, firms, institutes and the nature of the products or services served. According to Harvey and Green (1993), the differentiation in quality interpretation based on the conceptualisations of the quality

is divided into five discrete groups, namely exception, perfection, values, transformative, money or income, and purpose.

Quality is an act that affects many aspects, people (customer), employees, partnerships, stakeholders, and owners. Each of them views quality from a certain angle and defines quality according to its effects. The quality level also depends on all stakeholders collaborating to achieve a good impression. For instance, employees view quality as good programmes organised by the firm and help them to work excellently. The lack of quality may delay productivity. Customers consider quality a good way to receive a satisfactory service or purchase good products.

The lack of quality is regarded as bad products or services, which is also dependent on the word-of-mouth spread by others. Companies can gain profitability through loyal customers because they spread free advertising by mouth-of-word to their friends and family members about a firm's products or services. According to AL-Mhasnah et al. (2018), if the customer is happy with the products or services, the customer will spread positive word-of-mouth to three to four people about the features of the products or services. Unfortunately, if the customer is unhappy, they will spread negative word-of-mouth to 20 others and advise them not to use the products or services.

Quality is crucial for a firm's survival and prosperity. In order to attain quality, many elements must be applied in quality programmes implemented in organisations, such as good infrastructure, qualified staff, and others. The primary reasons for applying quality programmes are to achieve and gain a good reputation and prosperity, leading to customer satisfaction and, subsequently, loyalty. Modern management science believes that the success of a business depends on the quality of work. The notion has received increasing

attention in recent periods and led to variations in the concept. Quality programmes have started early and developed over time. Today, the concept is known as total quality management (TQM), with additional concepts integrated and applied to any operation or company as it is a management idea.

The interest in quality began after World War 2. Edward Deming, commonly regarded as the top management thinker in the quality industry, came from America to Japan to assist in TQM implementation. Japan became the first country to embrace TQM (Svensson & Klefsjö, 2006). Japanese companies dominated the world industrial market in the 1980s when they became the best choice for customers by offering low prices and good quality (Ahire & Golhar, 1996). In Japan, TQM was taken seriously, contrary in the United States (US) in this time. The Japanese focused on the efficiencies and affectivity of shopping through vital techniques (Bocker & Overgaard, 2016). Following the success of Japan, the US started to accept the new TQM principles and changed its model to fit the 19th century as its prior techniques were outdated (El-Tohamy et al., 2015).

Many pioneers have discussed quality. Among the most popular scholars were W. Edward Deming, Joseph M. Juran, and Philip Crosby from America and Genchi Taguchi and Kaoru Ishikawa from Japan (Beckford, 2009; Speegle, 2010). The interest in quality management (QM) began in the last three decades as a hall strategy to create a competitive relationship between companies (Sadegh et al., 2013). The values are essential for QM to attain positive effects on organisational outcomes, which is the most important aspect in firms (Calvo-Mora et al., 2014).

The main aim of applying TQM in industries is to improve quality programmes and processes and reduce costs and time in providing

services or producing products. The TQM initiative can be applied through the following (Mustafa, 2012):

1. Create environmental support and sustain continuous improvement
2. Involve all employees in the improvement process
3. Observe and improve the measurement tools
4. Empower employees by improving their skills and knowledge
5. Manage changes and processes based on knowledge and facts
6. Cut down the ineffective process

B. The definition of quality

The word quality has many definitions varying from conventional to strategic. Conventional definitions of quality usually describe the direct characteristics of a product such as: performance, reliability, ease of use, aesthetics, and so on. Meanwhile, the strategic definition of quality is: quality is everything that is able to meet the needs of customers. In Quality Vocabulary, quality is defined as the totality of characteristics of a product that support its ability to satisfy specified or established needs. Quality is often defined as customer satisfaction (customer statification) or conformity to needs or requirements. (Vincent Gaspersz, 2011:6)

Goetsch and Davis created a definition of quality that is broader in scope, namely: "Quality is a dynamic condition related to products, services, people, processes and environments that meet or exceed expectations." Deming stated that quality is a predictable level of uniformity and dependability at low costs and in accordance with the market. Meanwhile J.M. Juran defines it as fit for use, which implies that a product or service must be able to meet the expectations of its users (Tjiptono and Anastasia, 2003:4).

Based on the basic understanding of quality above, it can be concluded that quality always focuses on customers (customer focused

quality). In this way, a product is designed, produced and services provided to meet customer needs. Because quality refers to everything that determines customer satisfaction, a product or service can be said to be of quality if it meets customer needs, can be utilized well, and is produced (produced) in a good and correct manner.

Two critical meaning for quality has been mentioned by Juran (Angelov et al., 2008). First, quality is a product's features. It refers to the product's characteristics in terms of the shape or values that the product or services (end result) offer. This type of quality boosts an organisation's income. The high quality leads to continuously buying the products, leading to higher profit. Second, quality is freedom from deficiencies. The product or services have a good quality without deficiencies, faults, errors, and mistakes. The high quality of the product or services is reflected in the high costs. Hence, the second type of quality is also related to cost.

The meaning of quality based on the pioneer's opinions and researchers differs. Some of these definitions are:

1. **Quality is a degree of superlative**
   According to this definition, superlative is luxury or excellence in the products. It refers to how luxurious and optimal are the features and characteristics of the products. For example, an Apple iPhone is considered the best in the market. The superlative quality is very costly to consumers due to its characteristics.

2. **Quality means fitness for use**
   Products or services should be able to cater for their offering. Hence, products or services will be saleable because the customer's contribution determines the features of the products and the acceptable cost.

3. **Quality means conformity with the requirements**
   Customers and producers determine the conformity of products or services to the features or characters. The producers' features should be determined in the manufacturing process. In contrast, the customer features are determined in the purchase contracts and agreements or through direct purchase and specification of requirements by customers or examination of products whether it fulfils the required specifications. Hence, the customer evaluates the quality level.

4. **Quality means customer focus**
   Products must meet customer needs and requirements (announced and undeclared). The level of customers' requirements determines the level of quality that needs to be achieved and concurrently achieve the basics in the products and services. This definition is confirmed by International Organisation for Standardisation (ISO) 9000.

Some of the quality definitions provided by the pioneers of quality are stated below.

- Juran: He implied that a product satisfies the customer's demands, resulting in customer satisfaction. Quality also refers to all the operations an organisation undertakes to guarantee that the product satisfies the consumer's needs.
- Feigenbaum: He regards quality as an effective system for integrating the service and product development, quality improvement, and quality maintenance efforts of an organisation's various groups in order to deliver products and services at the most cost-effective levels while ensuring complete customer satisfaction.

- Crosby: Quality is conforming to requirements. Crosby stressed that it arises from error prevention and not from correction. Quality can also be measured by matching costs.
- Deming: Quality is to convert the user's future demands into quantifiable features to ensure that a product or service may be created and supplied to satisfy the customers' paying capability.
- Taguchi: The amount of loss that can be prevented and that the manufacturer could inflict on society after delivery, including failure to live up to consumer expectations, performance flaws, and negative side effects, including pollution and noise.
- ISO: Quality is the "degree to which a set of inherent characteristics fulfils the requirement."

Attakora-amaniampong et al. (2014) stated that QM implications exist. Moreover, no single definition explains the whole picture as scholars view QM from different perspectives, affecting how they portray it. Nevertheless, Rahman and Osmangani (2015) stressed that QM is based on three different systems, namely responsibilities of quality bosses, standard quality models, and exploratory examinations. The meaning of QM changes according to scholars and different places, as clearly seen from its implications.

Deming et al. (1982) expressed that QM is a strategy used by an organisation's board to enhance the quality and effectiveness of relationships. The authors opined that QM is pertinent to all relationships with no constraint based on the size and nature of the affiliation. Besides, QM can be portrayed as a practical system used in planning quality improvement attempts of different relationships inside an association to achieve perfect administration (Vallejo et al., 2006).

As there are various thoughts concerning the implications of QM, deciphering its meaning is difficult. Regardless, certain definitions can elucidate what QM defines. For example, El-Tohamy and Raoush (2015) portrayed QM as the progress of a relationship focused on consumer loyalty through steady improvement, which changes from one association to the following. Nevertheless, it has certain benchmarks, which can be executed to guarantee a part of the general business. On the other hand, Attakora-amaniampong et al. (2014) described QM as a hard and fast corporate strategy focusing on meeting and outperforming clients' wants through reducing costs by observing another organisation's structure and reasonable condition. Al-Shdaifat (2015) highlighted QM as a presentation improvement methodology for individuals, get-togethers, and associations.

Several scholars believe that QM is an approach to managing high ground. For instance, Shafiq et al. (2019) delineated QM as an approach to managing to improve an organisation's influence, profitability, and versatility. Rahman et al. (2015) stated that QM is a strategy for expanding advantages by continually improving each point of various level features. In addition, different viewpoints exist concerning QM. As mentioned by Sadeh (2017), QM is viewed as a segment of social change. Attakora-amaniampong et al. (2014) found that QM contains three critical sections, namely perspectives, structures, and contraptions. According to Mansour (2017), QM comprises characteristics, frameworks, and gadgets which reinforce one another to construct internal and external client steadfastness for any possible event or cost.

Al-Abri and Al-Balushi (2014) reported that QM is a perspective that incorporates everyone in an association on the consistent endeavour of improving quality. Subsequently, Swies et al. (2017) described QM as a specific organisational hypothesis that

involves steady improvement in each viewpoint in an association's development to pass on benefits to clients based on their needs under the top management's directive. Additionally, several scholars have prescribed a system approach for QM. Al-Shdaifat (2015) characterised QM as a system involving practices, instruments, and techniques for managing associations in a rapidly advancing setting. On the other hand, Kenneth (2012) observed QM as an altered structure rather than viewing it as many perspectives and systems used by a relationship to bring constant improvement. Alrabeah et al. (2015) stated that QM is a combined way of executives' thinking and involves numerous practices that emphasise continuous improvement, meeting customers' wants, diminishing to patch up, since quite a while ago run reasoning, delegate intrigue and coordinated effort, process update, forceful benchmarking, basic reasoning gathering, enduring results estimation, and creating a strong relationship with the providers.

In addition, QM is normally insinuated as social development (Al-Shdaifat, 2015). Thus, it is not only an instrument and a focused structure. Moreover, QM is related to association, which is similarly a social structure. Waller et al. (2017) stated that associations are systems similar to structures. Additionally, AL-Mhasnah et al. (2018) highlighted that QM is a people-focused organisational structure which consolidates systems, structures, and mechanical assemblies that point to incessant augmentation in buyer dedication at a reliable lower cost. Furthermore, Maria Stock et al. (2017) expressed that QM requires high organisational obligation, activity, preparedness, and a joint effort between the groups, which are the key parts of a productive composition of QM.

Most TQM pioneers have been attempting to define and explain TQM. It is a hall strategy and comprises three words (total, quality,

and management). Every word in this term has individual definitions. The individual definitions are integrated to create TQM definitions and principles. In this context, TQM is a value producer, cooperating with everyone in the company, and the system of unifying goals to produce the best products and services matching customer needs and expectations (Cole, 1998).

One of the modern managerial concepts that aim to improve and develop performance continually by answering customer needs is TQM. First, the quality definition increases customer satisfaction (Armand, 1956). Compliance with requirements (Crospe, 1979; Joran, 1989), the accuracy of answering as viewed by customers, and Deming's point of view that expected a degree of consistency fit the market at a low cost (Academy & Education, 2012).

Before discussing the self-assessment to achieve TQM, the TQM concepts should be understood. There is no unique description that fits TQM. Hellsten and Klefsjö (2000) revealed that some efforts to define TQM were vague and unclear (Hellsten & Klefsjö, 2000). Deming stated, "The trouble with Total Quality Management, the failure of TQM, you can call it, is that there is no such thing. It is a buzzword. I have never used the term, as it carries no meaning" (Deming, 1994b, p. 22). Besides, TQM is stated as "a corporate culture characterised by increased customer satisfaction through continuous improvements, in which all employees in the firm actively participate" (Dahlgaard et al., 1998). Additionally, TQM is also defined as "an approach to improving the competitiveness, efficiency, and flexibility of a whole organisation" (Oakland, 1989). According to Dale (1999), "TQM is the cooperation of everyone in an organisation and associated business processes to produce products and services which meet and, hopefully, exceed the needs and expectations of customers. TQM is both a philosophy and a set of guiding principles for managing

an organisation." Today, people acknowledge that TQM comprises several values that constitute the company culture. A few of these values differ among authors but finally discuss the same vital aspects and core values (Hellsten, 1997). The core values discussed by several authors (Bergman & Klefsjo, 2003; Svensson & Klefsjö, 2006) are:

1) Focus on customers
2) Focus on processes
3) Improve continuously
4) Base decisions on facts
5) Let everybody be committed
6) The commitment of leadership

Recently, authors have viewed QM from the system perspective. The core value cannot provide a hall view for the QM (Shiba, 1993; Dean & Bowen, 1994). As Hellsten & Klefsjö (2000) stated, TQM comprise values, tools, and approaches to constitute a management system. According to the management system view by Hellsten and Klefsjö (2000), a TQM-triad consists of three components that are inter-reliant and sustenance to each other, namely "focus on processes," "process maps", and "control charts," which are examples of tools to be used within "process management." With their universal views, the three components help companies apply TQM easier and provide customer satisfaction by meeting their needs (Hellsten & Klefsjö, 2000).

Conventionally, quality is a characteristic of goods or services in the form of reliability, ease of use, ease of maintenance, beauty, and so on. From the manufacturer's side, quality is in the form of product conformity to established standards. Meanwhile, from the consumer side, quality is in the form of achieving the customer's desires or expectations for a product.

In the era of globalization, quality can be defined as anything that is able to meet customer needs and expectations, or the conformity between customer needs and the company's offerings. The higher the quality of the product, the higher the level of customer satisfaction with the product. Product or service excellence can be measured through the level of customer satisfaction.

Based on its characteristics, quality can be characterized in five aspects, namely customer orientation, active participation led by top management, understanding of the responsibility for fulfilling quality, activities oriented towards preventing damage, and a philosophy that makes quality a way of life or how to achieve goals.

Meanwhile, Quality Management is defined as an effort to continuously improve performance at every level or operational process or functional area in organizational life by using all available resources. Several important things contained in this definition are quality planning, quality assurance and quality improvement.

Until now, various concepts of quality and quality management have been developed which have been written by experts, along with the history of development or time. The concept of quality and quality management initially emerged from western countries, but developed and can be applied well in Japan, which is very disciplined in implementing this quality culture. The quality culture in this country has made Japan superior to America in implementing quality concepts and quality management.

In this era of globalization, all parties demand quality achievement. Many people are willing to pay a lot to get quality products or services. The characteristics of the current business environment are characterized by rapid development in all fields. Competition is not only about how high the company's productivity

level is and how low the price level of products or services is, but more about the quality of the product or service, namely in the form of comfort, convenience, as well as accuracy and speed in achieving it. World economic competition is becoming increasingly fierce, requiring management expertise in anticipating every change that occurs in world economic activity.

To face this competition, the business world is required to be able to make changes. There are three characteristics of the image of change that are widely discussed, namely temporaryness, diversity and newness. Transience is shown, among other things, by the shorter life of a product. The age of a product is not determined by whether the product is technically functional or not, but because the product no longer meets the demands of society due to technological developments, changes in consumer tastes and changes in the pattern of competition.

Diversity can be seen in the increasing number of types of products circulating on the market which are not limited to consumer's goods, but also in the types of technology offered. In addition, producers and customers in general are often faced with new things that have never been imagined before, new technology, new science, new products and services, new lifestyles, new hopes, and so on.

To maintain consistent quality of products and services produced and in accordance with market demands, it is necessary to carry out quality control over the process activities carried out. From quality control which is based on inspections with the acceptance of products that meet the requirements and rejecting those that do not meet the requirements so that a lot of material, energy and time is wasted, the idea emerged to create a system that can prevent quality problems from arising so that mistakes that have occurred do not happen again.

Quality is a hot topic in the business and academic world. However, this term requires a careful response and needs to be interpreted carefully. The main factor that determines the performance of a company is the quality of the goods and services produced. Quality products and services are products and services that match what consumers want. Therefore, organizations/companies need to know their consumers or customers and know their needs and desires.

There are many definitions and meanings of quality, in fact one definition or understanding is almost the same as another definition or understanding. The definition of quality according to several well-known experts includes:

Ishikawa (1943) "quality to improve organizational performance with cause and effect diagrams used to diagnose quality problems". Juran (1992) "quality is suitability for its purpose or benefit". Crosby (1979) "quality is conformity with needs which include availability, delivery, reliability, maintainability and cost effectiveness".

Deming (1986) "quality must aim to meet customer needs now and in the future". Garvin (1987) "quality is related to several approaches, namely product based, user based, manufacturing based, and value based". Feigenbaum (1991) "quality is the overall characteristics of products and services which include marketing, engineering, manufacture and maintenance, or what is called the concept of organization wide total quality control where these products and services in their use will be in accordance with customer needs and expectations".

Scherkenbach (1991) “quality is determined by the customer; Customers want products and services that meet their needs and expectations at a certain price level that shows the value of the product." Elliot (1993) "quality is something different for different

people and depends on time and place, or is said to be appropriate to purpose".

Goetch and Davis (1995) "quality is a dynamic condition related to products, services, people, processes and environments that meet or exceed expectations". The term Quality cannot be separated from quality management which studies every area of operations management starting from planning product lines and facilities, to scheduling and monitoring results. On the other hand, quality is also part of all business functions, namely marketing, human resources, finance, etc.

In reality, achieving quality is a natural common cause for uniting business functions. Flyn et al. (1995) identified seven quality factors, namely management support, quality information, process management, product design, workforce management, supplier involvement.), and employee involvement (customer involvement).

In addition, quality requires a process of continuous improvement (continuous improvement process) and is measurable, both individually, organizationally, corporately and with national performance goals. This quality improvement requires management commitment, a strategic approach to the quality system, quality measurement, process improvement, education and training, and reducing the causes of problems. Management, employee and government support for quality improvement is important for the ability to compete effectively in the global market.

Quality improvement is more than a business strategy, but is a personal responsibility, part of cultural heritage, and an important source of national pride. Commitment to quality is an attitude that is formulated and demonstrated in every sphere of activity and life,

and has the characteristics of the closest relationship with members of society.

C. The quality of evolution

Quality Evolution or Quality development has been going on for a long time, which has formed a long journey until now. The development of quality in the industrial world has developed from a non-quality culture at the beginning of industry to the best quality system today.

In the current era of modern globalization, quality is no longer an option but has become a necessity. You may have seen advertisements or billboards in your city saying that they are better, faster, safer, etc. They try to position themselves as if they are superior to others, more profitable than their competitors. Now it is time that quality no longer just talks about products or services, but is more than that. Quality has played an important role in marketing and branding. Remember carefully that a company can only generate profits if it has a target market with a profitable market share. If marketing and branding are the keywords, then quality is the most important component that supports them.

The first quality applications began at the beginning of the 20th century in the industrial sector, where quality was examined in the final product before selling it to the customer to ensure no manufacturing defects or damages. If repairs were required on defective products, they could be corrected (Wafa, 2012). The stages passed by the quality are divided into two main parts, namely, attention to the opinion of customers and needs or vice versa (Mustafa, 2012). The parts include the users of the services or products.

1. Overlooking the opinion of customers or needs

a) Inspection (The beginning of the Industrial Revolution - 1940)

In the inspection stage, the products in the final stage are evaluated to guarantee whether the properties of the products fulfil the manufacturer's standards. If the products are not up to the manufacturer's standards, the manufacturing process is repeated. Hence, this step requires more employees and time and increases financial loss.

At this time, and possibly at the beginning of the industrial revolution, the number of producers was far fewer than market demand. In this way, the producer says "let the consumer be careful". Producers just supply their products to the market without caring too much about quality, and at that time they can make huge profits. Because of the large profits it promises, the business attracts more people or business people to do the same thing. Competition is becoming more intense and fierce.

Supply is increasing and consumers have more choices. Suppliers began carrying out inspections to separate defective products from good ones. This is especially true for finished goods. During this time, screening is carried out on finished goods, and damaged ones are repaired if possible. The cause of the failure is identified and corrective action to not repeat similar errors is taken. Screening and repair costs are added to production costs, resulting in reduced profits. Quality improvement is reactive, not proactive, but is based on defects or problems that have been discovered.

b) Quality Control (1940-1960)

After inspection, quality control appeared between 1940 and 1960 and was introduced by Walter A. Shewhart. The primary aim of quality control is to evaluate the dissimilarity in the operation system

(Holmes, 1983; Badri, 2001). Quality control concerns product testing, the responsibility of supervisors, limited quality criteria, a paper-based system, and self-inspection (Plunkett & Dale, 1988).

This period is marked by widely utilised statistics charts in manufacturing, particularly performance and quality. Statistical charts, such as the Pareto chart and cause and effect chart, proved their effectiveness in diagnosing and detecting the problems. This period focused on the processing stage and was the responsibility of everyone in the firms. Furthermore, it involved monitoring the deviations in the result and customer satisfaction.

In this development, quality is controlled in every production process. A process approach is starting to be implemented but is still more focused on the product, not the process. Variety is recognized as the enemy of quality. For this reason, statistics and control sheets were developed to monitor variations. Quality manuals and basic quality plans began to be developed and "self-checks" were implemented for each process owner.

c) Quality Assurance (1980-1960)

The problem in quality assurance appeared during the self-assessment. The situation caused a loss of time and products. Hence, the need to improve the process became important between 1960 to 1990 (Holmes, 1983; Badri, 2001). Quality assurance applies several important processes in manufacturing companies, including cause and effects analysis, external accreditation, and statistical process control (Craft, 2003).

During this period, the primary goal was not to detect any discrepancies in the product's quality during the inspection. Nevertheless, the objective is to assure the quality of the products and services by utilising new methods and programmes to achieve

the expected quality and detect faults. Zero defect is one of the advantages of this period.

This period is an era of standardization. In addition to the controls mentioned in the "Quality Control era", a third party audit and approval system was also established. The quality manual is further developed to meet standard requirements with a detailed quality plan. Statistically Controlled Process (Statistical Process Control) begins to be implemented. Quality standardization is increasingly being developed. ISO9000 (IS0 9001, 9002, 9003 version 1987 & 1994) is one of the best known internationally. This system developed from the 1980s to the 1990s.

2. Interested in the opinion of the users of the products or services

This stage appeared when competitiveness started between companies, and the need to offer products and services according to the customers' needs and expectations became prevalent (Mustafa, 2012).

a) TQM

It is a programme that includes new ideas, principles, and tools to evaluate and rebuild the system's functioning according to customers' needs and expectations (Mustafa, 2012). Juran's TQM fund in Japan, as a strategic hall system, has put Japan first in the industrial world (Li et al., 2003). The TQM initiative focuses on all parts, departments, and partnerships in organisations, including employees, processes, customers, and suppliers. It implements policies and procedures to control productivity and service delivery and integrates customer needs, capabilities, and infrastructures as processing inputs. Furthermore, the goals and objectives have been pre-fixed. Besides, TQM calls for continuous improvement akin to customer needs and expectations.

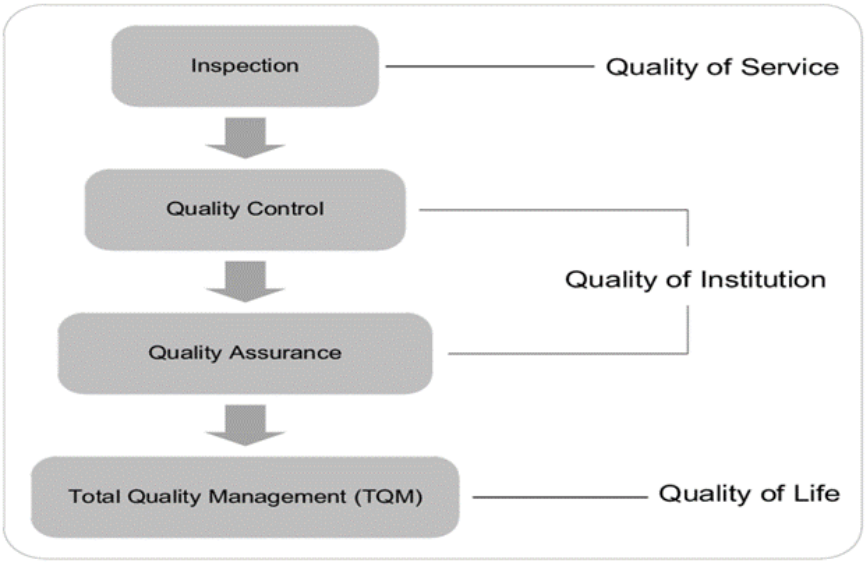
This period is still developing to this day and "continuous improvement" is the main theme. With the understanding that consumer requirements are a constantly moving target, as consumer experience and knowledge increases, quality needs to develop over time. Consumer experience and knowledge will simultaneously form certain consumer perceptions, which are called "customer mindset". “Customer mindset” will also be influenced by education, competitor actions, previous experience, etc. As a result, consumer expectations will also change over time. To respond to this, producers must also change or, more precisely, "raise" their quality. And this process will never end as long as the human brain can still learn.

b) Excellence

Excellence appeared as a reaction from the American pioneer towards TQM. Japan developed the TQM principles to suit Japanese companies. Nevertheless, when American companies attempted applying TQM, they adopted the principles without adapting them to suit American companies. Hence, they created new principles without specifying the way to achieve them (which is excellence), such as European Foundation for Quality Management (EFQM) model and the King Abdullah II award in Jordan (Mustafa, 2012). The quality development stages are shown in the figure below.

To achieve continuous development, every process from entrant to customer must be involved. Non-production aspects such as marketing, finance & human resources must be managed simultaneously. Quality is the collective result of all processes that take place interactively. Quality management models and quality standards have been developed using the Total Quality Management (TQM) approach. MBNQA (Malcolm Baldridge National Quality Award) in America and the EFQM (European Foundation for Quality Management) "Excellence Model" in Europe are the best examples

of TQM efforts. Meanwhile, "six-sigma quality" was pioneered and developed by Motorola.



In the current era of modern globalization, quality is no longer an option but has become a necessity. You may have seen advertisements or billboards in your city saying that they are better, faster, safer, and so on. They try to position themselves as if they are superior to others, more profitable than their competitors. Now it is time that quality no longer just talks about products or services, but is more than that. Quality has played an important role in marketing and branding. Remember carefully that a company can only generate profits if it has a target market with a profitable market share. If marketing and branding are the keywords, then quality is the most important component that supports them.

Old Days – Let the consumer be the conscientious one

At this time, and possibly at the beginning of the industrial revolution, the number of producers was far fewer than market

demand. In this way, the producer says "let the consumer be careful". Producers just supply their products to the market without caring too much about quality, and at that time they can make huge profits.

This is the stage where quality has not been considered at all, occurring at the beginning of the industrial era.

So an industry makes processes and produces products as they are which just flow. When a product is defective or fails, just throw it away and replace it with another product that suits the customer's wishes. Therefore, there is a lot of disappointment from customers who receive defective or failed products.

Age of Inspection – Separating the bad from the good

Because of the large profits it promises, the business attracts more people or business people to do the same thing. Competition is becoming more intense and fierce. Supply is increasing and consumers have more choices. Suppliers began carrying out inspections to separate defective products from good ones. This is especially true for finished goods. During this time, screening is carried out on finished goods, and damaged ones are repaired if possible. The cause of the failure is identified and corrective action to not repeat similar errors is taken. Screening and repair costs are added to production costs, resulting in reduced profits. Quality improvement is reactive, not proactive, but is based on defects or problems that have been discovered.

An improvement from the previous stage is by checking or inspecting the results of the production process. So, if there is a defective product, it will be separated to prevent customers from getting a product that is not of good quality.

Age of Quality Control – Controlling quality throughout the production process

In this development, quality is controlled in every production process. A process approach is starting to be implemented but is still more focused on the product, not the process. Variety is recognized as the enemy of quality. For this reason, statistics and control sheets were developed to monitor variations. Quality manuals and basic quality plans began to be developed and "self-checks" were implemented for each process owner.

At this time, producers are aware of and implement checks or inspections carried out in the following parts of the process:

- **Input**: In the material preparation section before entering the process, defective products will be separated and returned to the supplier.
- **Process**: Checks are carried out in the process stages, here also defective products will be separated.
- **Output**: There is a check on the results of the production process, if there is a defective product in the process output it will also be separated.

Era of Quality Assurance – Guaranteeing quality that meets standards

This period is an era of standardization. In addition to the controls mentioned in the "Quality Control era", a third party audit and approval system was also established. The quality manual is further developed to meet standard requirements with a detailed quality plan. Statistically Controlled Process (Statistical Process Control) begins to be implemented. Quality standardization is increasingly being developed. ISO9000 (IS0 9001, 9002, 9003 version

1987 & 1994) is one of the best known internationally. This system developed from the 1980s to the 1990s.

Next, the QA (Quality Assurance) era is still making improvements as in stage 3, but there are additional activities. The added activity is to carry out problem analysis and prevention for the three parts mentioned above.

The Age of Integrated Quality Management (Total Quality Management-TQM)

During this QM period, the manufacturer has made improvements as per stage 4 (QA), which has been added to the management system.

This management system is applied in the following process parts:

- **Input**: Supplier and Resource Management.
- **Process**: Management Planning and Improvement.
- **Output**: Customer Management.

During this period of quality evolution, which is called TPM (Total Quality Management), improvements are made as per stage 4, which is supplemented by Management Strategy. This management strategy is to instill quality awareness in all processes within the organization. In general, this is done using a continuous improvement cycle method such as:

- PDCA (Plan, Do, Check, Action)
- DMAIC (Define, Measure, Improve, Control)

Quality through management and involvement of all parties. This period is still developing today and "continuous improvement" is the main theme. With the understanding that consumer requirements are

a constantly moving target, as consumer experience and knowledge increases, quality needs to develop over time. Consumer experience and knowledge will simultaneously form certain consumer perceptions, which are called "customer mindset". “Customer mindset” will also be influenced by education, competitor actions, previous experience, etc. As a result, consumer expectations will also change over time. To respond to this, producers must also change or, more precisely, "raise" their quality. And this process will never end as long as the human brain can still learn.

To achieve continuous development, every process from entrant to customer must be involved. Non-production aspects such as marketing, finance & human resources must be managed simultaneously. Quality is the collective result of all processes that take place interactively. Quality management models and quality standards have been developed using the Total Quality Management (TQM) approach. MBNQA (Malcolm Baldridge National Quality Award) in America and the EFQM (European Foundation for Quality Management) "Excellence Model" in Europe are the best examples of TQM efforts. Meanwhile, "six-sigma quality" has been pioneered and developed by Motorola. The philosophy is "Good quality is resulting from good management".

Chapter 2.
Quality Pioneers

After the definitions of quality management and TQM were improvised, TQM theories proposed by pioneers in the field began to emerge. They established the theory of TQM and contributed to improving TQM. The prominent quality pioneers discussed in this study are Edward Deming, Joseph Juran, Philip Crosby, Kaoru Ishikawa, and Masaki Imai.

A. Edward Deming (1900-1994)

Edward Deming was an American and a university professor. The Americans ignored Deming's theories and ideas. Nevertheless, he was requested by the Japanese government after the Second World War to help them improve productivity and their manufacturing industry's quality. Deming's involvement is one of the reasons for Japan's superiority in quality, particularly in its statistical monitoring applications. One of Deming's most critical contributions to TQM was the 14 points to be fulfilled when implementing TQM in institutions, which were included in Deming's book, "Out of the Crisis" (Sadegh et al., 2013). As an appreciation for his role in developing a prosperous Japan, they introduced the Deming Prize, which is given annually to

institutions that achieved outstanding TQM. Today, Deming is recognised as the father of quality.

Edwards Deming is best known for his 14 Points for Management, which emphasize the importance of leadership, continuous improvement, and the involvement of all employees in the pursuit of quality. He advocated for a systemic approach to quality management, focusing on reducing process variation through statistical process control (SPC). Deming's philosophy is often summarized by the PDCA (Plan-Do-Check-Act) cycle.

William Edwards Deming is known as one of the "Great Quality Pioneers". Born in Sioux City, Iowa, Deming earned his bachelor's degree from the University of Wyoming, then earned a master's degree at the University of Colorado and completed his doctorate at Yale. Deming began his career as a statician at Western Electric, where he studied for several years with Walter Shewhart. Deming succeeded in putting Shewhart's statistical control theory into practice that could be applied in the industrial world. The concept that led him to Total Quality Management.

Deming's greatest contribution was when he helped Japan recover its economy after experiencing defeat due to World War II. During an interview with NBC, Deming showed the American people the success of industry in Japan in rising to improve the quality of its products. Because of this, Deming was asked by several large companies such as: General Motors, Ford, and Florida Light & Power to help improve their performance. Deming was also a professor at many American universities. Deming was also a popular adherent of the PDCA (Plan-Do-Check-Act) cycle, or the Deming/Shewhart Cycle which he learned from Walter Shewhart.

Deming is known for his 14 Key Points for Successful Japanese Transformation, which essentially states that costs can be reduced if fewer defects/rework are made and machine downtime is minimized. As a result, productivity increases and customers buy prime quality products at affordable prices. Apart from that, Deming is also known for the theory of the Seven Deadly Diseases or the seven obstacles that management faces when making changes and also the System of Profound Knowledge which teaches managers to be willing to see organizations from a perspective that makes them believe that transformation must be carried out to achieve long-term success.

Deming died in 1993, at the age of 93. At that time he was still a Professor of Statistics at New York University. His contribution has helped the company improve product quality in line with reducing costs. Some of the awards received by Deming are: Taylor Key Award (1983), Shewhart Medal from the American Society for Quality Control (1955), Science and Technology Hall of Fame (1986) and the National Medal of Technology from President Ronald Reagan (1987).

Deming was a Quality Teacher. He is the one who promotes that Top Management and employees are equal in getting comfortable working conditions. "Top Management is important, but it is the employees who keep the business running."

Many consider Deming to be the father of the Total Quality Management movement. Deming noted success in leading the quality revolution in Japan, namely by introducing the use of problem solving techniques and statistical process control. For great services to Japanese industry, every year an award called the Deming prize is given to every company that excels in terms of quality. The Deming prize itself is divided into two categories, namely the Deming Prize

for individuals who have contributed to quality control and Japanese statistical methods and the Deming Application Prize which is given to companies that carry out their company's quality control and statistical quality control well.

Deming recommended the use of SPC (which was first developed by Shewhart) so that companies can distinguish systematic causes from special causes in dealing with quality. He believes that differences or variations are a fact that cannot be avoided in industrial life. The main contributions that made him famous are the Deming Cycle, Deming Fouteen Points, and Seven Deadly Diseases.

1. Deming's Philosophy

According to Deming, when specific management concepts are implemented, a possibility exists for the organisation involved to increase product quality and concurrently save costs. Reducing the production of waste, litigation, and retaining employees enable cost savings besides sustaining customer loyalty. In his view, Deming opined that the manufacturing process should be seen cohesively and not as a collection of unrelated elements. The key to achieving excellent quality is to strive for improvement continuously. Several Japanese advocates of Deming in the 1970s summed up his ideas in a two-part comparison:

> Quality, which is determined by the formula "Quality = Results of Work Efforts/Total Costs," should be the primary emphasis of organisations. Both quality and expenses rise over time when quality is emphasised. In contrast, quality eventually declines as expenses continue to climb when an organisation's primary goal is to save costs.

2. The Deming Cycle

The Deming Cycle is also termed the Shewhart Cycle. The cycle, which is often abbreviated as the PDCA (Plan-Do-Check-Act), emerged from the need to connect manufacturing activities with customer demands while also concentrating departmental resources in a cooperative effort to address the needs.

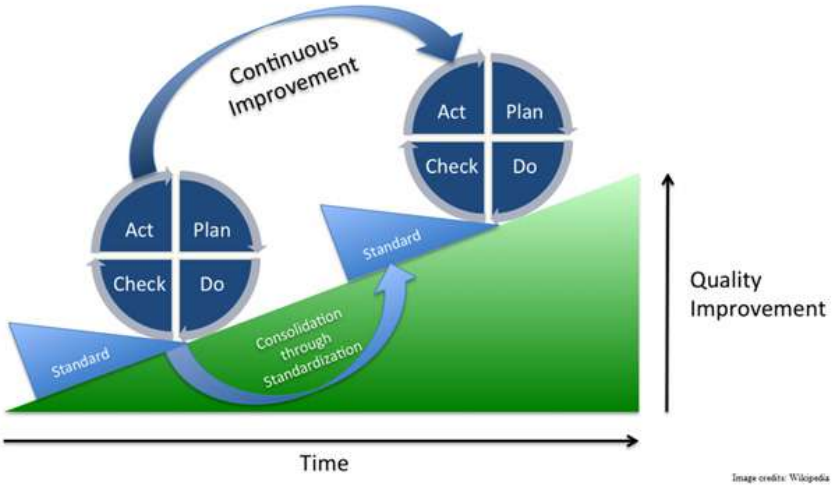


Figure 2.1 Deming Cycle

The PDCA cycle is based on the following stages:

1. **Plan**: A methodology concerning consumer research is designed to build awareness of the business process components.
2. **Do**: The devised plan is implemented to evaluate the plan's performance.
3. **Check**: The performance of the plan is assessed. The assessment findings are reported to the decision-makers.
4. **Act/Adjust**: The required changes are identified, concluded, and implemented.

3. The 14 Points for Management

Deming's 14 Points for Management, a series of guidelines for managers attempting to enhance organisational effectiveness, are his second major contribution. The points are listed below.

1) Maintain a constant focus on improving services and products
2) Adopt a new philosophy
3) Avoid reliance on mass inspection
4) Eliminate the practice of awarding contracts based on price tags
5) Consistently strive to enhance the organisation's productivity and service
6) Introduce modern and sophisticated on-the-job training methods
7) Utilise modern supervisory approaches
8) Fear should be let go
9) Remove barriers between staff areas
10) Eliminate the workforce's numerical targets that were established
11) Work standards and numerical quotas must be eliminated

12) Remove the impediments that workers face
13) Create a robust training and education programme
14) Develop senior leadership that will work towards achieving the goals

4. The Seven Deadly Diseases for Management

Deming's Seven Deadly Diseases of Management are the most critical and grievous impediments that managers confront while striving to boost effectiveness and introduce continuous improvement.

1. The inability to plan a service or product due to a lack of consistency in purpose
2. Organisations that prioritise short-term earnings
3. Using personal evaluation systems to analyse employee yearly reviews, performance, and merit ratings
4. Constant job switching
5. Management is based only on visible figures, with little or no regard for unseen or incomprehensible figures
6. An overabundance of medical expenses
7. Excessive liability expenses

B. Joseph Juran (1904 - 1987)

Juran, who has 2 undergraduate degrees (engineering and law), is the founder of the Juran Institute, Inc. In Wilton, Connecticut. This Institute is engaged in training, research and quality management consulting.

Juran defines quality as fitness for use, which means that a product or service must be able to meet the expectations of its users. The definition of fit for use contains 5 main dimensions, namely

design quality, suitability quality, availability, safety and field of use.

Juran once received an award from the Emperor of Japan in the form of an Order of the Sacred Treasure medal for his efforts in developing the quality of Japanese culture and fostering friendship between Japan and the United States. Juran's most famous contributions include Juran's Three basic Steps to Progress, Juran's Ten Steps to Quality Improvement, The Pareto Principle, and The Juran Trilogy. Apart from that, Juran also developed the concept of Managing Business Process Quality, which is a technique for implementing cross-functional quality improvements.

A quality and quality management evangelist, Joseph Juran is another prominent figure of the 20th century in the quality field. Juran, born in 1904, is a Romanian-born American management consultant and engineer. Juran's concept, similar to Deming's, gained traction in Japan. He emphasised the significance of a comprehensive, organisational-level approach to quality, arguing that overall quality management begins at the top and reaches the bottom.

Juran also contributed to the consolidation of comprehensive quality concepts in Japan, although he was an American. Juran formulated his ideas in his book "The Quality Control Handbook," which is considered the most comprehensive book for all aspects of quality, monitoring, and confirmation. Juran designed a method for the consumer, which can be an essential factor in the organisational processes related to production and services. This technique contained three planning processes and included a method whereby the consumer can be the main factor in quality planning, quality control, and quality improvement (Mustaf, 2012).

In 1941, Juran was introduced to Vilfredo Pareto's work. He assessed the Pareto principle (the 80-20 rule). The Pareto principle

implies that for most occurrences, around 80% of consequences flowed from 20% of causes and adapted to quality concerns. As a result, Juran stated that 20% of the causes produce 80% of the challenges in an organisation. This concept is also known as the "Vital Few and the Trivial Many" rule. In his later years, Juran favoured "the Vital Few and the Useful Many," implying that the remaining 80% of the reasons should not be entirely neglected.

Joseph Juran emphasized that quality should be managed like any other business function and stressed the importance of top management's commitment to quality. Juran's quality management philosophy is encapsulated in the Juran Trilogy, which consists of quality planning, quality control, and quality improvement. He also introduced the Pareto Principle in quality management, which states that a few causes are responsible for most problems.

1. Juran's Philosophy

The end-product quality that Deming emphasised in his era was the goal of many companies. The human aspects of quality management soon became Juran's focus in the subsequent years. Training and management education was emphasised as a requirement. Juran opined that the reluctance to change and the difficulties of human relations are among the issues in quality.

The Pareto Principle

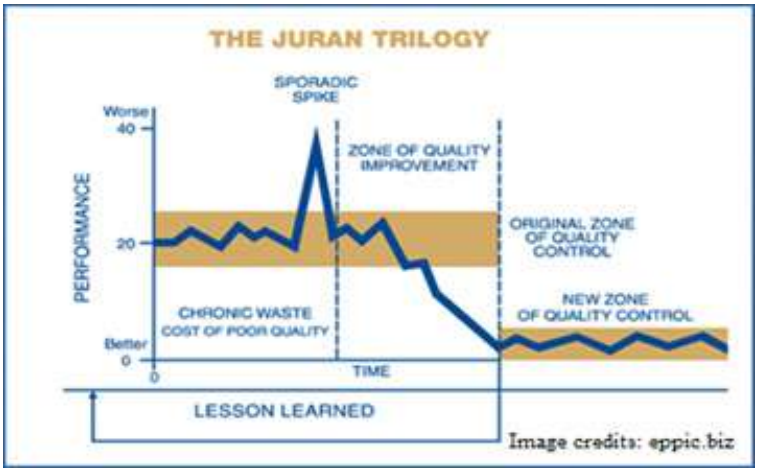
Juran applied the principles put forward by Vilfredo Pareto to management. This principle is sometimes also called the 80/20 rule, which says "80% of the trouble comes from 20% of the problems". According to this principle, organizations should focus their energy on eliminating the few but vital sources of problems that cause the majority of problems. Both Juran and Deming believed that the system controlled by management was the system where most problems occurred.

2. The Juran Quality Trilogy

In the Juran trilogy diagram, the major focus of any firm is a graph with time on the horizontal axis and the expense of poor quality on the vertical axis. The starting step is quality planning. The planners identify who the consumers are and their requirements. The planners then create processes and product designs to meet those requirements. Finally, the planners submit the blueprints to the operating employees, which is relevant to the saying, "You run the process, produce the product features, and meet the customer's needs." The vertical scale varies when the trilogy diagram is implemented to product characteristics. The scale may still display units of measurement such as mean time between failures, millions of instructions per second, percentage of on-time delivery, and others. The scale that goes up is excellent in such graphs, and a sensible, generic vertical scale is product saleability.

Among the pioneers of writing on poor quality and its expense, Juran introduced the cross-functional management method, which entails three legislative processes, namely quality planning, quality control, and quality improvement. The process to increase awareness of the necessity of improvising, determining specific goals, and

formulating goal-attaining strategies. The process emerges from the commitment of the management to strategic planning that requires skilled and educated employees. The procedure developing process for quality testing on items is known as quality control. Progress and change are needed to deviate from the norm. Finally, quality improvement is a continuous process of striving for excellence. Continuous quality improvements are required in this process. In order to develop solutions, issues must be identified to their root causes. When tasks are successfully accomplished, management must evaluate the methods and procedures and give feedback with acknowledgement and appreciation.



The "Juran trilogy" refers to these processes. They are similar to the techniques that have long been used to manage money. Financial planning, control, and improvement are examples of financial processes. The financial analogy demonstrates to managers that quality can be managed by employing similar planning, control, and improvement procedures. Managers are not required to adjust their conceptual approach because the trilogy notion is identical to that employed in managing money. Most of their past training

and expertise in financial management are transferable to quality management.

The Juran Trilogy is a summary of the three main managerial functions. Juran's view of these functions is explained as follows:

Quality Planning. Quality planning includes developing products, systems and processes needed to meet or exceed customer expectations. The steps required for this are:

1. Determining who is the customer.
2. Identify customer needs.
3. Develop products with features that can meet customer needs.
4. Develop systems and processes that enable the organization to produce these benefits.
5. Disseminate the plan to the operational level.

Quality Control. Quality control includes the following steps:

1. Assess actual quality performance.
2. Compare performance with goals.
3. Act on the difference between performance and goals.

Quality Improvement. Quality improvements must be carried out ongoing and continuously. The steps that can be taken are:

1. Develop the necessary infrastructure to carry out quality improvements every year.
2. Identify parts that need repair and carry out repair projects.
3. Forming these teams is what they need to be able to diagnose problems to determine the source of the main cause, provide solutions, and carry out controls that will maintain the profits obtained.

3. Three Steps to Progress

Juran also created the Three Basic Steps to Progress, which he believes businesses must apply in order to attain high quality.

1. Make organised changes on a routine basis with commitment and a feeling of urgency
2. Create a comprehensive training programme
3. Foster dedication and leadership at the highest levels of management

4. Ten Steps to Quality

Juran developed ten measures for firms to do in order to improve their quality, as listed below.

1. Raise awareness of the need and opportunities for improvement
2. Establish improvement objectives
3. Plan ahead of time to accomplish the objectives that have been established
4. Provide training
5. Undertake projects focused at problem-solving
6. Report on progress
7. Acknowledge others
8. Communicate the outcomes
9. Maintain a score
10. Retain momentum by incorporating continuous improvement into the organisation's regular operations.

C. Philip Crosby (1926 - 2001)

Philip B. Crosby, a businessman and author who was born in 1926, made contributions to quality management techniques and management theory. Compared to Deming and Juran, he began his career in quality

considerably later. He established the global quality improvement consulting company known as Philip Crosby and Associates.

Philip Crosby's approach to quality management is based on his concept of "Zero Defects," which asserts that organizations should strive for perfection and not accept any level of defects. He developed the "Four Absolutes of Quality Management" and the "Quality Vaccine," which are principles that guide organizations in implementing a culture of quality. Crosby also stressed the importance of prevention over inspection.

Crosby was a quality supervisor and examined in a US company. He is considered the founder or faculty of quality. Based on the idea of quality improvement has two concepts (Wiemann & Backlund, 1980):

1) Quality management
2) Basic elements of development

Crosby is famous for advocating zero defect management and prevention, which opposes statistically acceptable quality levels. He is also known for Quality Vaccine and Crosby's Foruteen Steps to Quality Improvement.

Crosby's views are summarized in a summary which he calls the Postulates of Quality Management. These arguments are put forward to answer the following main questions:

1. What is meant by quality?
2. What kind of system is needed to produce quality?
3. What performance standards should be used?
4. What kind of measurement system is needed?

First postulate: The definition of quality is the same as the requirements. In the past, quality was translated as the level of

goodness or goodness. This definition has a weakness, namely that it does not explain specifically how good it is. For example, Shandy wants a nice motorbike. This is very subjective. That's what good looks like. What are the criteria? How's the speed? Is it a sporty model? Save fuel? Easy to get spare parts? One that doesn't break quickly? Is this all unclear?

The definition of quality according to Crosby is meeting or being the same as the requirements (conformance to requirements). If you miss the requirements even a little, then all products or services are said to be of poor quality. These requirements can change according to customer desires, organizational needs, suppliers and sources, government, technology, and markets or competition.

Second proposition: the quality system is prevention: In the past the quality system was an assessment. For example, in a TV factory, at the end of the process it is stated whether the TV produced is bad or good. This final assessment only states that if it is good it will be handed over to the distributor, whereas if it is bad it will be thrown away. This kind of assessment does not solve the problem, because the bad will always be there. Why not take precautions from the start so that the output is guaranteed to be good and save money and time. In this case, it is known as the law of tens. This means that if we find an error at the beginning of the second process, the cost will be 10 rupiah. It was discovered that in the next process the cost would be 100 rupiah. So according to Crosby, the quality system is prevention.

In a process there must be input and output. In the internal work process itself there are 4 input controls where the prevention process can be carried out, namely:

1. Facilities and equipment.
2. Training and knowledge.

3. Procedures, standard operating guidelines/manuals, and quality standard guidelines.
4. Performance/achievement standards.

Third postulate: zero defect is the performance standard that must be used. The concept that applied in the past was a concept that was close enough, for example engine efficiency approaching 95 percent. But try to calculate how much 5 percent inefficiency multiplied by sales is. If you measure it in rupiah, you will realize its enormous value. People often get caught up in percentage values, so Crosby proposed the concept of zero damage, which he said could be achieved if companies did things right the first time and every time.

Fourth postulate: the measure of quality is the price of non conformance. Quality must be something that can be measured. The costs to produce quality must also be measurable. According to Crosby, quality costs are the sum of the price of non-conformance and the price of conformance. Price of non conformance (PONC) is the cost incurred if a task is carried out due to an error.

1. Crosby's Philosophy

When faced with the quality problem, Crosby responded with "Doing It Right the First Time." He described quality as complete and perfect compliance with the needs of customers. The Basic Elements of Improvement and the Absolutes of Quality Management represent the essence of his thinking.

2. The Absolutes of Quality Management

Crosby identified four Quality Management Absolutes listed below:

1) The First Absolute: Quality is defined as compliance with specifications

2) The Next Absolute: The quality system is based on prevention
3) The Third Absolute: The performance standard represents zero faults
4) The Final Absolute: The cost of non-conformance is used to quantify the quality

3. Zero Defects

Crosby's Zero Defects is a performance strategy and standard which asserts that employees must commit to paying special attention to details and avoiding mistakes. The strategy moves them closer to their goal of having no faults. Crosby defined zero defects as a concept that should affect every decision undertaken rather than merely a manufacturing practice. Managerial ideas of undesirable flaws and employees doing "things properly the first time" are encouraged.

4. The 14 Steps to Quality Improvement

1) Clearly highlight that management is dedicated to long-term quality
2) Establish cross-departmental quality teams
3) Determine the locations of present and prospective problems
4) Determine the cost of quality and describe its application as a management tool
5) Raise the quality consciousness and personal dedication of all employees. Take quick action to address the issues that have been discovered.
6) Implement a zero-defect programme
7) Prepare supervisors to undertake their roles in the quality programme
8) Organise a Zero Defects Day to inform all employees of the new direction

9) Motivate individuals and teams to work on personal and team development
10) Encourage staff to notify management if they are experiencing difficulties attaining quality objectives
11) Appreciate employees who take part
12) Adopt quality controls to encourage ongoing communication
13) Repeat all to show that quality improvement is an ongoing activity
14) Do it all over again – quality improvement does not end

5. The Quality Vaccine

Crosby emphasised that this immunisation was the antidote to low quality in organisations.

1. Integrity: Quality should be considered seriously across the business, from top to bottom. The organisation's future will be determined by the quality of its products.
2. Systems: For quality costs, performance, education, improvement, review, and customer satisfaction, the correct measures and systems are required.
3. Communication: Communication is crucial in every company. It is necessary to explain the organisation's standards, requirements, and possibilities for improvement. Listening carefully to consumers and employees and adopting input will provide the firm with a competitive advantage.
4. Operations: In every organisation, a culture of improvement must be the norm with a robust process.
5. Policies: Implemented policies should be uniform and clear throughout the company.

D. Kaoru Ishikawa (1915 - 1989)

Born in 1915, Kaoru Ishikawa later earned his engineering degree in applied chemistry from the University of Tokyo. Ishikawa remained connected to Nissan until 1947 when he began to work as a professor at a university. Known as the "Father of Japanese Quality," Ishikawa created essential quality concepts and tools, including company-wide quality control and the Fishbone diagram (a cause-and-effect diagram) often employed in the examination of industrial processes.

He was a crucial contributor to the creation of the Quality Circle idea. Ishikawa was of the opinion that improved internal coordination and collaboration have a positive impact on consumer requirements, which eventually results in process efficiency and higher-quality goods and services. Ishikawa emphasised the necessity for top-level management to assist the teams that they were in charge of continuously. He was awarded the Shewhart Medal and the Order of the Sacred Treasure (Japan) for his excellent technical leadership in the modern quality control field.

1. Kaoru Ishikawa's Contribution to the Theory of Process Improvement

i. **Fishbone Diagram (Cause & Effect Diagram)** – Due to its design, Kaoru Ishikawa's tool is termed the Fishbone Diagram. It is one of the seven fundamental instruments for quality control. The barriers are grouped together in a fishbone diagram to show which variables have the most influence. The Ishikawa diagram is frequently utilised in defect prevention and product design to identify the factors contributing to the final outcome.

ii. **Implementation of Quality Circles**: A group of people voluntarily convene on a regular basis to discuss and find

solutions to problems relating to their jobs. An organisation's general culture and improvements in manufacturing processes, product design and occupational health and safety are the goals of a quality circle. This idea was initially introduced in Japan in 1962 by Nippon Wireless and Telegraph Company. Edward Deming first introduced the concept of Quality Circles in 1950, and Ishikawa subsequently developed it. Quality Circles are formal teams of individuals who have received training from experts in skills and human factors, issue identification, data collection, analysis, and solution formulation.

iii. **Emphasis on Internal Customer**: Ishikawa argued that relying too much on experts would restrict the potential for progress for all employees. Therefore, it was necessary for employees at all organisational levels to participate fully. Every department has the ability to improve the overall quality. As a result, all departments should include statistical methods in their internal and external auditing programmes. Company-wide refers to operations that span the whole organisation and focus on not only internal quality control but also sensitive customer care management quality, after-sales support, and human factors.

In the field of quality control and process development, Kaoru Ishikawa's work is unrivalled. Global organisations utilise the cause and effect diagram to identify the causes for quality gaps and the impact of such gaps on the whole operation of the organisation. He popularised the notion of Quality Circles and Internal Customers, highlighting the strategic value of an organisation's personnel. He emphasised the need to involve all employees instead of depending solely on specialists. The involvement of all employees contributes to the general growth of employees in terms of organisational processes. Additional training can contribute to the emergence of volunteer

groups known as Quality Circles. The groups can discover and fix numerous quality problems in a company under the supervision of an expert.

E. Masaaki Imai - Kaizen

Masaaki Imai founded the Kaizen Institute in Switzerland in 1985 to assist businesses in implementing the discipline of Kaizen and the numerous systems and techniques known today as Lean Management. In the last three decades, Mr Imai has written articles and books, given seminars on Kaizen, quality, leadership, Lean Management, and other management topics, advised worldwide corporations, and popularised Kaizen as a common sense method for constant improvement across every inhabited continent.

His contribution has been to integrate numerous Kaizen management approaches, including Just-in-time, TQM, and TPM, into client organisations' cultural settings. He was the pioneer to organise study trips to Japan to learn about Kaizen and Lean processes, a service that the Kaizen Institute maintains to provide currently, having guided over 200 groups and 4,000 individuals. Mr Imai addresses both leadership and frontline challenges at the Gemba, or "the real place where value is added." He recognises the stages necessary to transform a corporation from a result-oriented to a process-oriented organisation. The Kaizen principle aids in increasing staff behaviour and productivity in order to enhance production processes while decreasing waste of energy and money. Following the adoption of the Kaizen principle in Japan, innovation has become an essential component of organisations (Norazlan et al., 2014).

Other management methods differ from the Kaizen theory. Development occurs only when a problem exists and only in the sector where the problem arose. Besides, development is the responsibility

of one person or a particular group of employees. Any activity in traditional systems contains both beneficial and unhelpful work, whereas Kaizen includes both useful and harmful work (Ferreira & Saurin, 2019). The table below summarises the details of the pioneers, their philosophies, and theories.

Pioneer	Philosophy	Theory/ Concepts
Edward Deming	• The higher quality, the lower the cost • Quality is achieved in institutions through the process of continuous improvement	• Deming Cycle (PDCA) • 14 Points for Management
Joseph Juran	Juran focused on the importance of the human resource in quality through training and education for them. He also focused on the end product like Deming.	• Juran Quality Trilogy • Three Steps to Progress • Ten Steps to Quality
Philip Crosby	Quality as full and perfect conformance to the customers' requirements	• Absolutes of Quality Management • Zero Defects • The Fourteen Steps to Quality Improvement • The Quality Vaccine

Kaoru Ishikawa	• Quality control cycles • The importance of inclusion of quality control on after-sales service and employee participation at all levels of the quality control process	• Fishbone Diagram (Cause & Effect Diagram) • Quality Circles • Emphasis on Internal Customer
Masaaki Imai-Kaizen Pioneer	Quality improvement system used by everyone	• Kaizen

Comparative Views of Quality

	Deming	Juran	Crosby
1. Definition of Quality 2. Level of senior management responsibility 3. Achievement/ motivation standards 4. General approach 5. Structure 6. Statistical process control (statistical process control)	A predictable level of uniformity and dependability at low, market-appropriate costs Responsible for 94% of quality problems Quality has many 'scales', so it is necessary to use statistics to measure achievements in all areas; Zero damage is very important Reduce diversity by making up continuously and stopping mass inspections	bility to use (Fitness of use) Less than 20% quality problems due to performance Avoiding campaigns to do a perfect job General management approach to quality, especially the human element 10 steps for quality improvement	In accordance with the requirements. Responsible for quality Zero damage (zero defects). Prevention, not inspection. 14 steps to quality improvement Rejecting statistically acceptable levels of quality

	Deming	Juran	Crosby
7. Repair Base. 8. Teamwork 9. Quality Costs 10 Purchases and goods received 11 Supplier assessment 12 Only one Sourcing of supply	14 points for management Statistical methods for specific control must be used Continuously reduce deviations; eliminating goals without methods Employee participation in decision making and solving obstacles between departments There is no optimum for continuous improvement Inspection too late; using acceptable quality levels No, critical of most systems	Recommends SPC but warns that SPC can result in a Total Driven Approach Group approach to projects; set goals Team approach and quality control group Quality is not free, there is an optimum Purchasing problems are complicated so a formal survey is needed Yes, but help suppliers improve No, it is negligible to increase competitiveness	A process, not a program, aims for improvement. Quality improvement group and Quality Council Cost of non-conformity, Quality is free. State the requirements; Suppliers are an extension

Chapter 3
Services Quality

A. Introduction

From the viewpoint of business management, service quality is a success in customer service, reflected in each service experience. Customers build service expectations based on word-of-mouth, prior experiences, and marketing materials. Customers generally evaluate perceived service with anticipated service. If the perceived service does not fulfill the expected service fail, customers become dissatisfied.

The degree to which the planned benefit matches the observed outcome is used to assess subjective aspects of customer service. This, in turn, is determined by the consumer's expectations of the service to be acquired and the talents and skills of the service provider to deliver the expectation. Successful businesses enhance their offerings with features that satisfy clients while also surprising and delighting them. Exceeding consumer expectations is the key to satisfying them.

Every consumer has idealistic anticipation of the service they expect to acquire when they visit a restaurant or a business. Service quality measures how efficiently a service is delivered in relation to the customer's expectations. Organizations that equal or surpass

anticipations are thought to offer high-quality service. Service quality is influenced by service potential (for instance, employee credentials), service process (such as the speed of service), and service outcome (customer satisfaction). How employees' services differ from what customers perceive they received is described by individual service quality. For example, it is reasonable to expect the ordered food in a restaurant to be served within five minutes after the order is placed. In case the order is received promptly after the customer gets the drinks ordered and finds a table to sit at, the service provided by the restaurant is regarded as high service quality.

Notably, in pure service systems, service quality is frequently viewed as the output of the service delivery system. Besides, client satisfaction and service quality are interrelated. The customer's perception determines service quality. Nevertheless, customers establish impressions about service quality based on a variety of factors, not only a sole factor.

Service quality is made up of two terms, 'service' and 'quality', emphasizing the provision of high-quality services to end customers. The standards or specifications that a service provider guarantees are described by quality. A clear line does not exist for quality. The possibilities for quality generation are endless. Scientific advancements and developments establish the way for the production of high-quality goods. The higher the frequency of innovations, the lesser the gaps in the process of quality improvement.

Service-producing companies, such as goods manufacturers, are proven to be vital in fostering research and developing a new service or product that distinguishes the services and schemes from rivals and offers lucrative market prospects to capitalise on for profit. Against this backdrop, the innovation process is more prevalent in industrialised countries. As customers who have tasted the pleasure

of world-class services anticipate similar services from other businesses, the produced quality sets the border of expectations. Expectations create opportunities for fulfilment or discontent. When an organization succeeds in meeting customers' expectations, they are pleased, and their contentment opens the door to expanding market share.

It is accurate to assert that service quality satisfaction is the outcome of increased resources and activity to meet user expectations. Service quality is separable into two categories, namely functional and technical quality. In order to improve the levels of service quality, the organizations that provide services must identify the causes of growing customer discontent and implement appropriate steps (functional or technical) to reduce it.

Service quality (SQ) or service quality is an achievement in an effort to answer all consumer needs. The service provided by the company to consumers aims to win the hearts of consumers so that they are finally willing to buy the products offered. If customer service is good, then consumers will definitely feel happy. When consumers are happy, the company's reputation looks good in their eyes. From there, there will be other positive impacts that follow.

B. Meaning of Service Quality

The definition of service quality according to J.Supranto (J.Supranto, 2006:226) is "a word that for service providers is something that must be done well". Meanwhile, according to Gronroos, the definition of service is an invisible activity or series of activities that occurs as a result of interactions between consumers and employees or other things provided by the service provider company which is intended to solve consumer/customer problems. (Ratminto, 2005:2)

Then according to Kotler (Kotler, 2000: 25), "service quality is the totality of the characteristics of goods and services that demonstrate their ability to satisfy customer needs, both obvious and hidden." For companies operating in the service sector, providing quality service to customers is an absolute must if the company wants to achieve success.

Service quality is an important component of customer perception, because it contains information regarding customer satisfaction (Ismail, Haron, Ibrahim, & Isa, 2006). Service Quality can be defined as the difference between customer expectations of service before and after the service is provided (Parasuraman, Zeithaml, & Berry, 1985; Cronin & Taylor, 1992; Bolton & Drew, 1991). Christopher (1986) defines service quality as the relationship between a company and its customers and focuses on the customer experience during the transaction process. This focus is not just about meeting customer needs, but whether the service meets customer expectations (Lewis, 1993). Maclaran & McGowan (1999) revealed that service quality can be an important focus in marketing strategy, because it contains many factors that can influence the process of making a product or service, until the product and service reaches the customer. So that if there are deficiencies in the process, they can be immediately evaluated to ensure customer satisfaction and loyalty.

Aga & Safakli (2007) say that if customer expectations of service are higher than the service received, then customers will feel less satisfied. However, this does not indicate that the service provided is of poor quality, but rather because customer expectations have not been met, customer dissatisfaction occurs. Most definitions of service quality converge at the intersection of customer needs and desires (Ueltschy & Krampf, 2001; Warraich, 2014). Rust & Oliver (1994) define quality as a customer's impression of an organization's services.

There are two fundamental concepts in measuring service quality, namely the concept developed by Grönroos (1984) & Parasuraman, Zeithaml, & Berry (1985). Grönroos (1984) said that perceived service quality is the result of a comparison between the services expected and provided. Parasuraman, Zeithaml, & Berry (1988) said that perceived service quality is defined as the level of difference between client perceptions and expectations. Basically, these two concepts emphasize that service quality is the result of a comparison between consumer expectations and what consumers feel after the service is provided.

In their research, Parasuraman, Zeithaml, & Berry (1988) measured service quality using the SERVQUAL method, which is divided into 5 dimensions and consists of 22 indicators. Meanwhile, Grönroos (1984) identified two components of service quality, namely, technical quality and functional quality. Technical quality is related to the final result of the service offering process. Meanwhile, functional quality is related to the interaction between the client and the service provider company, during the service process provided. In addition, the image of the service provider based on functional technical quality influences the perception of service quality.

The service delivery system's output is typically viewed as service quality in the context of pure service systems. Additionally, service quality and customer satisfaction are interrelated. Despite the disagreement among researchers over the direction of causality between satisfaction and quality, it is generally accepted that high service quality results in satisfied clients. For instance, when a customer checkouts of a hotel or leaves a restaurant and is asked whether they are satisfied with the service they had received, a "no" answer is an indication that the service provided was dissatisfactory.

Waitresses, who are direct service providers, highlighted that occasionally they are criticised despite providing the best services to the customers. Other factors, besides the service quality, cloud the customer's judgements. For instance, the customer reviews the service negatively because of their bad mood or disagreement with others before reaching the restaurant. Hence, the customer's physical and psychological conditions influence their satisfaction with the service quality, which most service providers also acknowledge.

The broadness of service quality research has greatly increased over the past fifteen years. The issue has garnered attention from scholars and practitioners because of the significant impact of customer perceptions regarding service quality on loyalty, brand equity, and customer satisfaction. Research on service quality has also expanded to a global scale, gained prominence, and garnered contributions from academics across various fields. Although there have been disagreements over a wide range of methodological concerns, the service quality conceptual model recommended by Parasuraman et al. that was later operationalised and improved by the same authors significantly influenced the majority of studies.

Service quality can be manifested in meeting consumer needs and expectations as well as the accuracy of delivery to match consumer expectations. Lovelock and Wirtz (2007) explain service quality as a long-term cognitive evaluation from consumers of the company's service delivery.

Zeithaml, Bitner & Gramler (2009) state "service quality, the customer's perception of the service component of a product, is also a critical determinant of customer satisfaction" this means, service quality is the consumer's perception of a set of services for a product unit, and also is an important determinant in obtaining consumer satisfaction.

Based on these various definitions it can be understood that service quality is by comparing consumers' perceptions of the services they actually get or receive with the services they actually want regarding the service attributes of a company.

C. Evaluation of Services Quality

Researchers have historically considered service quality to be extremely challenging to conceptualise and evaluate, owing to the intangible nature of services, which are frequently perceived subjectively. The so-called Nordic School was one of the first to debate the idea of service quality. The approach viewed service quality as comprising two essential dimensions:

1. **Technical quality**: Technical quality implies what a consumer obtains due to dealing with a service provider (lodging in a hotel, dining in a restaurant). Technical quality can be measured since it is largely objective. Nevertheless, it might be challenging to assess functional quality. The technical measures shift the focus on technological breakthroughs and developments that serve to raise the quality of services. It emphasises technology usage or chooses to provide a technology-driven service.
2. **Functional quality**: Functional quality implies the service is received by the client and the creative approach taken in providing the service (politeness, swiftness, attentiveness). The functional metrics shift the emphasis to improving the service quality offered by employees, which offers opportunities for company culture development, working style, designing a rewarding package, and behavioural profiles of workers or anything similar.

The frequency of technical advancements in comparison to the increasing impact of high-performing staff leads to the development

of user-friendly, technology-driven services with a new level of quality. Employers may improve their employees' functional quality by emphasizing behavioral dimensions such as attitudes, accessibility, service-mindedness, interpersonal interactions, appearance, and commitment. Undeniably, senior management did not intend for the system to incorporate low service quality or service outages.

The facts stated earlier show that the perception of service quality is always changing, with the prevailing drivers being the new technology generations adoption, the rise of quality professionals, and changes in boardroom attitudes. By encouraging the use of advanced technology and boosting the number of individually committed personnel, senior executives and top management are responsible for influencing how customers perceive the quality of their services. As a result, service-generating businesses should critically adhere to the philosophy of creating opportunities, which emphasizes quality generation.

D. Service Quality Concept

Customers must always come first when establishing the term "service quality" since they are the individuals who will ultimately determine whether the notion is met. Customers place the highest value on quality, which also serves as the foundation for their opinions. If their expectations are met, the service quality is attained. Service quality is an important factor when designing a service since it affects both the client profile and the demand volume for a particular service. In the current service market, service quality is a crucial positioning tool for service providers and their offerings.

Understanding how service quality affects profit and other financial measures of company success is crucial for services marketing. In the context of service marketing management,

service quality needs to be seen as a strategic force and the main challenge. Notably, service quality is an important source of a long-term competitive edge as it impacts the continuous improvement of service performance by boosting profit growth and market share. Resultantly, financial outcomes will improve, and a sustainable competitive advantage will be attained. Since not all rivals can offer the service quality that consumers demand, the quality-based service marketing approach is viable. Thus, establishing competing copycat marketing techniques is difficult as service organizations that build their tactics on quality have a strong reputation.

Consumers perceive quality within the service delivery process, while service providers outline and achieve it. The way customers perceive moments of truth has a direct impact on the rating of total quality service, particularly in services with recurrent deliveries, implying a highly professional strategy for moments of truth targeted at establishing and managing long-term customer relationships. Developing long-term consumer relationships and enhancing service quality necessitates an understanding of moments of truth, such as the actions carried out within them and the customer perception of them. Management of a quality-based service organization must pay special attention to four critical areas for quality attainment, namely the provider's corporate culture, service encounters (moments of truth), design, and productivity.

Since their functioning allows for optimal service delivery, service exchange in the market is not feasible without the right design of service supply systems. Based on whether the service provider is concentrated on attaining maximum efficiency, the choice between technical assistance and customer employees for the service delivery process is the primary problem in service design decision-making.

The underlying concept of service quality is that if a certain service can be defined, the customer's perception of service quality is tied to standardised established criteria. Since satisfaction is influenced by a greater diverse range of factors than quality, discrepancies over the nature of service quality are largely about the link between service quality and customer satisfaction.

Theoretically, the aim of service is basically to satisfy society, to achieve this satisfaction requires excellent service quality which is reflected in:

a. Transparency is a service that is open, easy and accessible to all parties who need it and is provided adequately and easily understood.

b. Accountability, is a service that can be accounted for in accordance with statutory provisions.

c. Conditional, is service that is in accordance with the conditions and abilities of the service provider and recipient while adhering to the principles of efficiency and effectiveness.

d. Participatory, is a service that can encourage community participation in providing public services by showing the aspirations, needs and hopes of the community.

e. Equality of Rights, is a service that does not discriminate from any aspect, especially ethnicity, race, religion, class, social status and so on. f. The balance of rights and obligations is a service that considers aspects of justice between the giver and recipient of public services.

Service Quality not only concerns the economic benefits of financial services but also anticipation of the side effects of increasing the role of banking services, such as crime and fraud. To

fulfill customer desires, needs and expectations, the company built a quality assurance system. This relates to efforts to ensure that the processes running within the company can guarantee the production and delivery of products (goods/services) that comply with customer specifications.

In a quality assurance system, important elements of quality assurance are built which enable personnel within the company to identify, design, develop, produce, deliver and support the production of products that meet customer needs. Therefore, whether the quality of service is good or not depends on the ability of the company and its staff to consistently meet customer expectations.

The main reasons why high service quality is important for an organization, there are:

a. Increase sales. Customers who perceive a company's service to be high quality are more likely to do business with that company. Additionally, customers who purchase from companies with high service quality are likely to continue purchasing from those companies on a regular basis.

b. Save marketing money. Retaining existing customers by offering high-quality service is usually cheaper than attracting new customers. This can attract quality employees. High-performing professionals generally prefer to work for companies with high service quality.

c. Lead to repeat business. Customers who see their problems and complaints resolved quickly and efficiently by a company's customer service department are more likely to purchase from that company again in the future.

d. Strengthen the company brand. A company's reputation with above average service quality can increase sales by attracting new customers or retaining existing customers.

e. Remove certain barriers to purchasing. High quality service can convince hesitant customers to make a purchase, because they know that if the service isn't right for them, they can rely on strong customer service to remedy the situation.

According to Vincent Gaspersz (Gaspersz, 2011:74-75), service quality in the service industry and business management sector has five key elements, including:

1) Reliability, which is the ability of the service provider to provide what is promised to the recipient. services (consumers) accurately. This attribute is related to service accuracy that is free from errors.

2) Assurance (Guarantee), related to the knowledge, politeness and ability of workers (service providers) to generate a sense of trust and confidence from service recipients (consumers) regarding the services received.

3) Tangibles, relating to physical facilities, equipment and appearance of service provider personnel.

4) Empathy, related to attention and concern from service providers to service recipients (consumers).

5) Responsiveness, related to the responsibility and desire to provide excellent services and help service recipients (consumers) when they face problems related to the services provided by the service provider.

From several definitions of service quality, it can be concluded that service quality is all forms of activities carried out by a company to meet customer expectations.

E. Service Quality Characteristics and Objectives

The main characteristics of service quality are as follows:

(i) Customers are an active component of the process, bearing preconceptions and anticipations that constitute their engagement with the organisation.

(ii) In contrast to a manufactured product, which can be made, checked, and controlled for quality before being supplied to the client, service quality cannot be validated prior to delivery.

(iii) Customers are keenly interested in the transaction's result or output and the procedure for achieving the outcome since they are integrally engaged in the process.

(iv) In a manufacturing setting, minimising variation is crucial to producing high-quality items. Client satisfaction in service delivery is dependent not on removing variation but instead on tailoring service delivery to the specific conditions of every transaction. The key to providing great service is to consistently apply specific principles instead of offering the same response to each transaction.

(v) The satisfaction of a client is subjective. It is comprised of two fundamental components: delivery perceptions and expectations. Depending on their individual experiences and requirements, clients have different expectations. Each of them has a unique perception of the information given to them. Their satisfaction will be impacted by any discrepancy between what they expected and what they truly experienced.

F. Dimension of Services Quality

Customers' expectations of a particular service are impacted by a variety of factors, such as recommendations, individual needs, and prior experiences. There may be a mismatch between the services that are perceived and the anticipated service. The service quality model, generally referred to as the "GAP model," was developed in 1985 to highlight the requirements for delivering high-quality services. The model finds five "gaps" that result in unsuccessful deliveries. Customers commonly compare and contrast the services they "receive" with those they "expect." If the experience falls short of the expectation, there is a gap. The expectancy-disconfirmation paradigm is the method used to assess service quality. Due to the focus on expectations, the paradigm is the dominant model in marketing literature and consumer behaviour.

The expectancy-disconfirmation paradigm is the foundation of the SERVQUAL model, which was developed by A. Parasuraman, Valarie A. Zeithaml, and Len Berry. It identifies the key dimensions (or components) of service quality and offers a scale for evaluating it. Ten service quality factors that affect consumers' perceptions of service quality were first discovered by the model's creators. However, after extensive testing and retesting, it was found that several of the qualities were autocorrelated, drastically integrating the dimensions to only five: assurance, empathy, reliability, tangibles, and responsiveness. The five dimensions reflect service quality parameters in a variety of sectors and contexts. An acronym constructed from the initial letter of each of the five dimensions, RATER is a popular mnemonic among marketing students.

Scholars have debated the validity of the expectancy-disconfirmation paradigm despite its prevalence. Scholars have

specifically emphasised that the expectancy-disconfirmation technique originated in consumer research and was primarily focused on evaluating customer satisfaction instead of service quality. In short, concerns are prevalent about the model's face validity and if service quality could be perceived as a gap.

The customer's perception determines service quality. Customers form opinions on service quality relying on a multitude of factors, not just one. Service marketers must grasp all of the factors that consumers utilise to assess service quality. In his article 'Competing on the Eight Dimensions of Quality,' David Garvin established the eight quality dimensions that apply to services and goods. Aesthetics, conformance, features, durability, performance, perceived quality or prestige, reliability, and serviceability are the eight dimensions. Parasuram et al. refined their prior factor identification and recognised five service quality dimensions as critical. The five dimensions are described below.

1. Reliability

Reliability or dependability is the company's ability to provide the right service from the first time without making mistakes and delivering services according to the specified time. In this case, a marketer is required to provide reliable products/services. Products/services should not be damaged. Employees of a company must also be honest in resolving problems so that consumers do not feel cheated.

Reliability refers to a company's efforts to provide appropriate service to its customers. Because the problems that customers have are different, you must be able to serve exactly what the customer needs. This element also refers to your availability to serve customers whenever needed.

Reliability is the company's ability to provide promised services accurately and reliably. There are 5 indicators of reliability, namely:

- Provide services as promised
- Reliable in handling customer service problems
- Deliver services correctly the first time
- Deliver services according to the promised time
- Save notes or documents without errors.

The dimension has been demonstrated to exert the greatest impact on consumers' quality perception. Reliability is the capacity to provide the promised service consistently and precisely. A service provider may be given another opportunity to offer a similar service during the 'recovery' phase if the service delivery fails the first time. Due to the first failure, the customer's expectations are often higher throughout the recovery period. As a result, the service provider tends to face increased scrutiny, raising the likelihood of consumer dissatisfaction. The reliability dimension, which assures on-time delivery on each occasion, assists the service provider in fully meeting client expectations at the minimum service expectation level.

2. Responsiveness

Responsiveness relates to employees' ability to help consumers and respond to their requests, as well as conveying when services will be distributed and then providing service quickly. Another important element in the Responsiveness element is that company employees are always ready to help consumers. Whatever one's position in the company, one should always pay attention to customers who contact the company.

Responsiveness here means providing timely responses to customers. The level of responsiveness can include the extent of

your curiosity about the level of customer difficulties, your ability to help customers with their problems, responsiveness to customer complaints and complaints, and others.

Service quality is an important factor for a company. So, make sure you improve your company's service to customers so that it will have a positive impact on the sustainability of your business. Qiscus is here to help your business understand what customers want and provide the most appropriate solutions.

Responsiveness is the willingness and ability of employees to help customers and respond to their requests, as well as informing them when services will be provided and providing services quickly. The indicators contained in responsiveness are:

- Provide information to customers about when services will be provided
- Provide service to customers promptly and quickly.
- Willingness to help customers
- Readiness to respond to customer requests.

The eagerness of the service firm's employees to assist customers and deliver timely service defines responsiveness. The readiness to serve the client or go the extra mile is also characterized as responsiveness. Customers want front-end staff to put in additional effort, although the staff may have been taught or equipped to provide standardized services. Customers may pose questions, make special requests, and submit complaints. In reality, each customer may have unique issues.

3. Assurance

Assurance is an employee's behavior that is able to inspire consumer confidence in the company and create a sense of security

for its consumers. Assurance also means that employees are always polite and have the knowledge and skills needed to resolve or answer any customer questions and problems.

Assurance strives for customers to have confidence in your company through friendly and alert service in making customer wishes come true. To be able to achieve this element, every employee must be given training on how to serve consumers well. Provide employees with all information related to the product and company, so that they are able to answer any questions or complaints raised by consumers.

Assurance is the ability and knowledge possessed by employees, as well as their ability to maintain the trust and confidence given by customers. There are 4 indicators in assurance, namely:

- Employees can foster customer trust
- Make employees feel safe when making transactions
- Employees behave politely in front of customers.
- Employee's ability to answer customer questions.

Assurance is described as the company's capability to foster customer confidence and trust in the delivery of services. Assurance also refers to the staff members' professionalism, courtesy, and capacity to instil confidence in the client towards the company. This element is crucial for services that involve high risk since customers may not be able to evaluate all of the risks connected with the process on their own.

The majority of buyers lack the technical expertise necessary to evaluate construction services. Nevertheless, potential clients are allowed to contact past clients. Prospective clients gain confidence and develop a more favorable opinion about the company when they

discover from existing clients about the company and its efficient delivery.

4. Empathy

Empathy is a company's attitude in understanding the problems of its consumers and behaving in the interests of consumers, as well as paying personal attention to consumers and having comfortable operating hours.

Good service is one that pays attention to its customers. Attention to customers can take the form of listening, helping find solutions, understanding anxiety, solidarity, not ignoring, and others. All of these actions will make customers think that your company really prioritizes customers.

Empathy is the care and attention given by individuals to users. The indicators contained in empathy are:

- Provide individual attention to customers
- Employees treat customers with full attention
- Employees know what customers need
- Prioritize customer interests
- Convenient operating hours (working hours).

Empathy alludes to the company's considerate, tailored service to every customer. The service provider may be able to understand the consumers' perspective better if he places himself in their position. Most customers may find it satisfactory when they believe the provider is trying his best to understand their point of view.

Although research using the SERVQUAL model has been widely criticized (Teas, 1994; Lewis & Mitchell, 1990; Lewis, 1993), this model has become the most widely used service quality measurement and is widely adopted in various service industries. For example, in medical

care services (Headly & Miller, 1993; Mangold & Babakus, 1991). Young, Lee, & Cunningham (1994) used it to examine the service quality perceived by airline passengers. In the accounting field, there are several studies that use the SERVQUAL measurement model (Weekes, Scott & Tidwell, 1996; Saxby, Ehlen & Koki, 2004; Hong & Goo, 2004). Berry et al. (1994) said that SERVQUAL has the ability to function as an effective investigative tool to guide management in efforts to improve service quality by focusing attention on areas that are most needed.

5. Tangibles

Physical evidence relates to the attractiveness of the employee's appearance and the materials used by the company. In this context, the facilities and infrastructure relating to customer service need to be considered by the company. Buildings with cooling facilities (AC), sophisticated telecommunications equipment or quality office furniture, etc. are considerations for consumers in determining a service.

The service provided to customers must be real because it can affect the quality of the service itself. Examples include shop conditions that are clean, neat, comfortable, have an attractive appearance, are not hot, and so on. Apart from the physical condition of the place, real service is also aimed at employees appearing neat, clean, fragrant, friendly, knowledgeable about the products offered, and so on. All of these things will certainly provide positive value in the eyes of consumers because they feel comfortable.

Tangibles describe the physical facilities, equipment and materials used by the company as well as the appearance of employees. Physical facilities are the company's ability to demonstrate its existence to external parties, for example from buildings. There are 4 tangible indicators, namely:

- Modern equipment
- Visually attractive facilities
- Employees who appear neat and professional
- Materials related to services that are visually attractive.

Tangibles relate to the staff appearances, physical facilities, and equipment of a service business. The purpose of tangible and physical proof of service is multifaceted. For instance, the patient in a clinic's waiting room is made aware of the kind of treatment he will be given by viewing the doctor's credentials.

If a dentist's clinic provides patients and their accompanying friends or families with clean rubber boots and freshly washed bibs or coats before the actual treatment, they will be satisfied. A dentist in a clean white coat will certainly awe them. Customer confirmation of service excellence is provided through tangibles.

G. Service Quality – Three Important Attributes

The process utilised to evaluate services for commodities is different from the method employed by customers. While products often have strong search qualities, services are more likely to have high perceived quality and experiences.

1. Search Qualities

Search qualities are characteristics that customers might examine before acquiring products or services. Colour, aesthetic, fitting, texture, scent, and pricing are all covered in the search qualities. Certain items, including footwear, washing machines, jeans, and automobiles, have strong search qualities. Raw materials, component parts, and office equipment (business items) are other popular search terms. As they are strong in search qualities, consumers can readily measure the item's quality before purchasing.

2. Experience Qualities

Consumers may only assess experience quality after or during the consumption process. Catering services, cosmetic surgery, entertainment, food, and meals are all services with a high level of experience. Delivery services, lawn services, and other services are examples of commercial services with extensive expertise. Evaluation occurs after the service has been utilised or while it is being consumed. For instance, a meal at a restaurant can only be appraised after it has been consumed, not before consumption.

3. Credence Qualities

Consumers have trouble judging credibility qualities even after their consumption is completed. Consumer services with strong credibility qualities include accounting services, burial services, education, and veterinary care. Financial consulting and advertising services are two examples from the business sector. Little consumers have medical or tax understanding to determine if the service provider managed to complete the service correctly. The situation is similar for a company attempting to assess consultancy or advertising services. Thus, assessing services with high credibility qualities is challenging.

H. Service Quality – Quality Standards

Initially, quality standards were formed in the setting of manufacturing and production. The primary motivation was to increase product compliance and quality. This exceptional performance currently extends to all aspects of marketing. All functional areas have an influence on the company's performance and levels of customer satisfaction. The goal of quality systems is to improve performance by focusing on processes and procedures. As a result, several quantifiable standards known as benchmarks are developed in order to sustain a predetermined service quality level.

In order to ensure service quality, a number of international quality performance standards have been employed, including International - ISO 9000, National - BS (British Standard) 5750, and European - EN 29000. One may argue that BS 5750 is the first standard of its kind. The standards for evaluating the service were provided by the British Standards Institute (BSI). The most important factor is that quality is actually determined by how the consumer perceives it.

Any organisation's quality management procedures should adhere to international standards such as the BSI's guidelines. Quality must apply to all organisational operations and be both practical and non-restrictive. Additionally, the dedication of everyone in the company, not only a designated quality manager, is required for high service quality. The customer receives greater value when the quality is higher. Improved business performance results from an entire organisation's efforts.

Ensuring high quality service usually varies slightly depending on the nature of the business, customer standards, and other factors. However, there are some common elements. The following steps can help you provide strong service quality to customers, including:

1) Understand what your customers want

Customers don't always have exact needs, so it's a company's responsibility to guide them and help them find the best solution for their specific situation.

2) Treat your customers with respect in any situation

Even when customer requests seem unreasonable, companies should treat them with the utmost respect and make customers feel that the company is empathetic to their concerns.

3) Respond to customer questions quickly and correctly

Providing relevant answers to customer questions can improve a company's image and reputation as an organization that offers good quality service.

4) Use customer feedback to make improvements

Encouraging customer feedback can help organizations understand areas where they can improve the quality of their services. Implementing such changes can show customers that the company is listening to their wishes and is willing to change its services.

5) Provide a friendly and efficient experience

Regardless of the services your company provides, a well-implemented customer interaction system can increase efficiency by allowing employees to process each customer with ease. A smooth customer experience, in general, can improve or strengthen a customer's perception of an organization's service quality.

6) Make sure customer-facing employees understand all services

All employees who interact with customers need to have extensive knowledge about company services in order to explain them effectively to customers. This can increase customer perceptions of the company's ability to provide quality services.

7) Be honest about service quality

When customers ask about a service or need to decide between several options, it is usually best for a company to be completely honest with them and fully disclose all the pros and cons of their choices. This can increase customer trust and therefore increase the chances of the customer returning.

1. Benchmarking

A business should now be able to establish quality standards that can be managed, monitored and satisfied consumer expectations after thoroughly researching quality concerns in its internal and external markets. Standard measurements must be established to satisfy quality standards. Measuring performance internally and externally requires the creation of a baseline value and a standard index. The organisation's operational standard is the baseline. This baseline may be considered as a benchmark or a metric by which performance can be assessed.

When discussing standards nowadays, it is necessary to compare them against rivals. For instance, an airline can assess its benchmark criteria by examining the quality standards of competing airlines. The standards of allied industries, including railways and other alternative routes of transportation, must also be studied by the airlines concurrently.

2. Implications of Service Standards

The globalised society humans live in now has higher service standards. Today's competitive and dynamic environment has resulted in a significant overhaul of service standards due to technological advances. A regular TV, which used to be a hotel's fundamental need, has now been replaced by LCD and SMART TVs. Internet access, once a luxury, has become a fundamental requirement for customers today. Resultantly, the bar for service quality standards is rising nowadays.

For instance, under a traditional measuring system, the instructor's performance was the sole service standard evaluated for the training. Three more elements, specific criteria such as the instructor's style, expertise, and class management, which may

influence the service quality of this training, may be discovered while doing market research on the target audience. In order to ensure that the measuring system resulting from the project is better able to assess the needs of the customers, the organisation should invest in customer-defined standards projects. Customers' level of expectations will result in customer-defined standards, which will direct the business towards specific behaviours and activities.

3. Customer Defined Service Standards

The guidelines and goals for employee performance are translated from customer requirements, which are determined by customer-defined standards. The standards are used as a benchmark and a guideline for communicating with consumers and providing service to them.

i. "Hard" Customer-Defined Standards

Things that can be examined, counted, or timed through audits are judged according to strict standards and measurements. An example of a hard service standard would be a customer complaint about delayed service and product delivery, and service quality errors. Hard service requirements for responsiveness ensure that the company matches the promptness or speed with which it delivers products to customers, addresses complaints, and responds to inquiries.

ii. "Soft" Customer-Defined Standards

Certain consumer expectations are impossible to measure, time, or examine during audits. For instance, the element of 'understanding and knowing the consumer' cannot be measured or witnessed. Therefore, perceptual measurements must be used to record the soft measures. These are opinion-based actions that may be performed

through speaking with clients, staff members, or other individuals. Soft standards provide staff with guidance and advice in order to achieve customer satisfaction, and they may be evaluated by taking into account the beliefs and expectations of the target audience.

I. Service Quality – Methods to Monitor Service Quality

Organisations should continuously assess the quality of their services besides implementing service quality improvement methods and quality management practices. Continuous quality assessment will make it easier for management to guarantee that customers are given the service quality that their organisation promises. The management may use the techniques described below to keep track of the service quality:

1. Undertake surveys on customers

Customer surveys should be conducted on a regular basis by service organizations to determine whether consumers have complaints about the services provided or the service staff. An example of a customer survey is Sheraton's customer survey. Customers should be provided with questionnaires to obtain their feedback and assess the quality of service the company provides. Additionally, efforts must be undertaken to identify the causes of any dissatisfaction.

Researchers or mystery shoppers who visit service outlets disguised as consumers can be employed to detect service quality issues. They pay close attention to the way the service is provided and customers' reactions to it. They will be able to discover any shortcomings present in the service processes. Subsequently, the required steps to correct the problems can be taken by the management.

2. Monitoring feedback from customers

Managers must pay close attention to consumer input, regardless of complaints, recommendations, or appreciations. In the case of complaints, management must endeavour to identify the root of the problems and avoid reoccurrence. If a client offers a recommendation, management must evaluate it, review it with staff to determine its applicability and practicality, and execute practicable and valuable ideas. When service personnel are complimented by customers, the management should motivate the personnel to strive and continuously provide quality service by appreciating and rewarding them.

3. Reviewing service blueprints and problem-tracking system

In order to identify any shortcomings, management must regularly assess the service plans. Additionally, if necessary, management should modify the problem-tracking and monitoring systems. The technique of portraying the full-service process in the form of a diagram or picture in order to verify that all phases in a service process are addressed is known as service blueprinting. A service manager may assess the success of the service on paper since the service blueprint includes data on every event and activity associated with the service. Furthermore, the service process can be modified by the service manager prior to implementing the regular testing procedures, such as test marketing. Service quality improvement is not an easy or simple task. Service quality may be enhanced by focusing on the strategies addressed below:

i. Determining primary determinants of quality

ii. Managing customer expectations

iii. Managing evidence

iv. Developing awareness among customers regarding the service

v. Establishing a quality culture

vi. Automating quality

vii. Monitoring the information system of service quality

viii. Utilising benchmarking anywhere possible

ix. Tracking internal, external, and quality maintenance costs

J. Service Quality – Top Three Models: Gap Model, SERVQUAL Model, and Critical Incident Model

The quality of service and customer satisfaction, expectations, loyalty, and perceptions require various measuring standards. A variety of measuring scales, attitudes, behaviour, and opinions must be employed when analysing these concepts. A minimum of viewpoints have been used to describe service quality:

(i) Excellence – Although the mark of an uncompromising student and high achievement, the attributes of excellence may change dramatically and rapidly. Excellence is frequently determined externally.

(ii) Value – Although it includes many different qualities, value and quality are two distinct concepts, with the former emphasising the benefit to the receiver and the latter focusing on the perception of matching or surpassing expectations.

(iii) Conformance to Requirements - It allows for exact measurement, although service users may not be aware of or concerned regarding internal specifications.

(iv) Achieving or Surpassing Expectations - Although this definition is broad and applicable to many service sectors, expectations

evolve and may be influenced by prior experiences with other service providers.

In-depth interviews, focus group discussions, observation studies, Critical Incidents Technique, SERVQUAL, and SERVPERF are among the present methods for gauging customers' perceptions and expectations. The methods are assessed for their applicability to services marketing in diverse settings.

1. Gap Model

The last perspective (achieving or surpassing expectations) has received the majority of attention from scholars and marketers. The Gaps Model of Service Quality, which offers service firms a framework for recognising services in the form of the gaps that fulfil (or fall short of) customers' expectations, reflects this perspective. A conceptual model of service quality in four different sectors was developed by Parasuraman et al. They discovered five gaps that could influence how consumers judge the quality of the services. Product maintenance and repair, credit cards, commercial banking, and securities brokerage are the sectors. The following five gaps were identified:

Gap 1: Consumer Expectation – Management Perception Gap

Service providers might not always be aware of the features required to satisfy customer expectations and the performance standards required to deliver high-quality service. This gap has an impact on how customers assess the quality of service.

Gap 2: Management Perception – Service Quality Specification Gap

The gap emerges when a company identifies what its consumers want but lacks the capacity to satisfy those needs. Resource limitations, market circumstances, and managerial apathy are a few reasons that

may have an impact on this disparity. The disparity could influence how customers perceive the quality of the services.

Gap 3: Service Quality Specifications – Service Delivery Gap

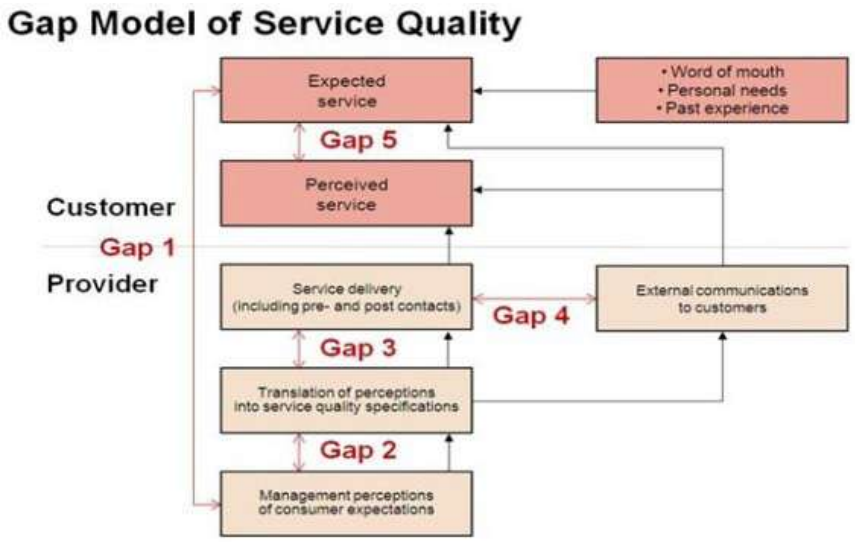
Businesses may have established policies for treating customers fairly and delivering exceptional customer service, but it does not ensure high-quality service. Employee performance cannot be standardized, although they play a significant part in ensuring that customers perceive the service as high quality. This gap impacts how services are provided, which in turn impacts how customers perceive the quality of those services.

Gap 4: Service Delivery – External Communications Gap

Consumer perceptions of the services received and their expectations for the quality of the services received might be influenced by external communications. Organizations may fail to notify customers about extra measures taken to ensure quality that is hidden from view, which may affect how customers see the quality of their services.

Gap 5: Expected Service – Perceived Service Gap

The findings of their research showed that surpassing customer expectations is essential for delivering outstanding service quality. Consumer expectations and actual performance are compared to determine if a service is of high or low quality in the customer's anticipation.



The SERVQUAL model, a multi-item scale created by Parasuraman et al. was later modified to measure customers' opinions of service quality in service and retail organisations. A customer-focused definition of service quality that measures the discrepancy between consumers' expectations for excellence and their impressions of the service received is based on the fifth gap. Although all five gaps may make cause difficulties for an organisation to provide high-quality service, the fifth gap is the most significant.

Customers' level of belief that a specific quality is required of the best service provider is known as their expectations. Perceptions are assessments of how well the service is performed. The Gaps Model and the idea of service quality are associated with Jeffrey E. Disend. According to him, poor service happens when there is a significant disparity between expectations and what is provided. Customers judge the service to be satisfactory when what is supplied meets what is anticipated. Exceptional service manifests when the level of service is higher than anticipated.

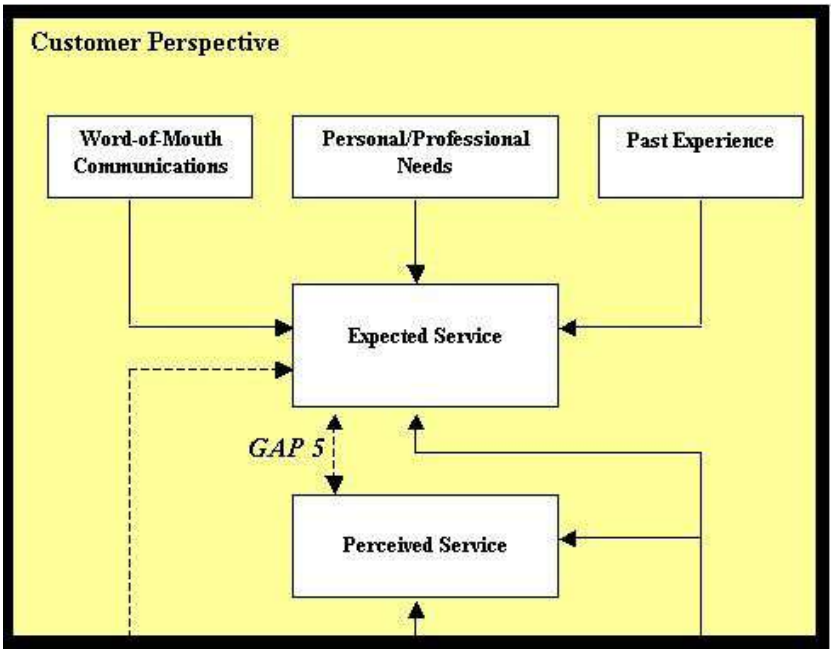
As a result, the gap is represented by a number (expectation ranking minus perception ranking) when perceptions and expectations are rated on a scale. A negative number indicates a bad service gap. The service is satisfactory if the value is zero (expectations match perceptions). If a positive value is generated (perceptions are better than expected), the service provider delivers excellent service. In truth, this definition is rather simple. A negative score might indicate great service.

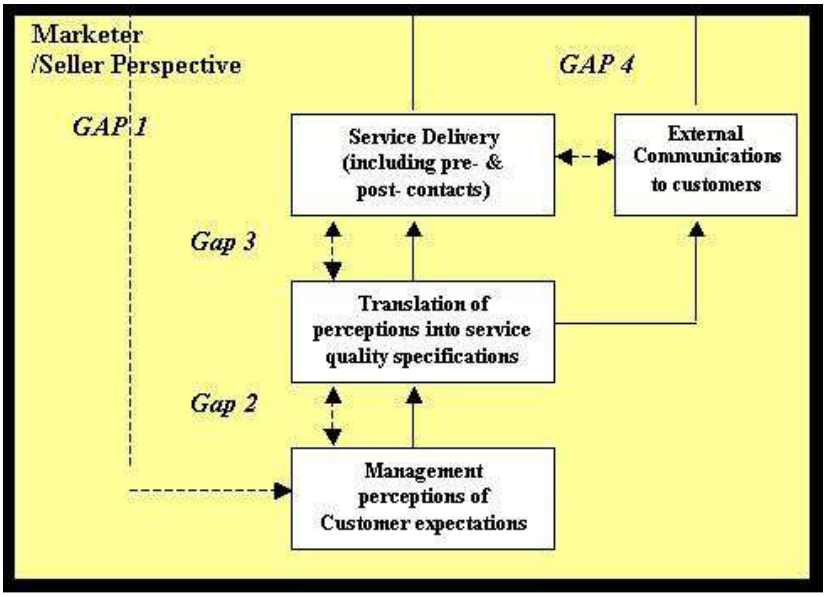
The concept of service quality in the Gaps Model recognises that expectations are subjective and neither predictable nor unchanging. The confirmation-disconfirmation theory, which compares expectations with performance, had an impact on the model's designers. A consumer has specific expectations before utilising a service. These expectations serve as a benchmark for actual performance.

A consumer can evaluate the expectations with the actual performance after experiencing service to determine if their perceptions are confirmed (if they meet), negatively disconfirmed (if expectations surpass perceptions), or positively disconfirmed (if perceptions surpass expectations). Terry G. Vavra prefers to use the terms "affirmed," "confirmed," and "disconfirmed" to represent the three circumstances in his discussion of satisfaction since he finds the term "positive disconfirmation" to be "confusing":

1. When perceived performance matches expectations, they are confirmed
2. When perceived performance surpasses expectations, they are affirmed (reinforced by positive dis¬confirmation)
3. When perceived performance falls short of expectations, they are disconfirmed (failed by negative disconfirmation)

Another widely used model of service quality is known as the five gap model (Kotler, Bowen, and Makens, 1996, pp. 357 - 361). Knowing what coustomers expect is the first and possibly the most critical step in delivering service quality. Thus, the marketing/ organization must know what customers expect to be able to provide services that customers perceive as excellent. This an extension of the marketing concept and consultative selling approach that: (a) first, learns through thorough questioning (read extensive market research) what the customer needs and wants (customer's problem that they want to be solved) and (b) second, delivering the product/service benefits that will solve the problem (satisfy the needs/wants).





The Gap Analysis Model of Service Quality

Source: Adapted from Kotler, P, Bowen, J and Makens, J. (1996). Marketing for Hospitality and Tourism. Upper Saddle River, NJ: Prentice Hall, p. 358.

Gap 1: Consumer Expectations vs. Management Perceptions

Often hospitality managers fail to understand what customers expect in the offered product/service. And, this includes understanding which features (of the product) are necessary to deliver high-quality service. Gap 1 occurs when this breakdown of understanding occurs. For example, a manager might develop a system to ensure that all guests wait no longer than 15 minutes to check in. If the hotel guest gets upset after a 10 minute wait, then Gap 1 exists.

Often, hospitality firms initially survey customers to understand their expectations. However, over time these customer expectations change (change is constantly happening). If the product/service does not adapt to these changes, then Gap 1 widens.

Ongoing research is essential to stay apprised of the changing customer expectations. Formal research plus informal research (managers walking around and talking to hospitality guests, for example) is one source of information. The salesforce, especially, for complex group business, is a vital source of changing customer expectations.

Gap 2: Management Perception vs. Service Quality Specifications

When hospitality managers know what customers expect, BUT cannot or will not develop products/services and systems to deliver it, then Gap 2 occurs. Several reasons for Gap 2 are:

1. Inadequate commitment to service quality,
2. Lack of perception of the feasibility of addressing customer expectations
3. Inadequate task standardization (within the hospitality organization)
4. Absence of goal-setting by management and inability to get employee "buy-in."

The hospitality industry has been accused of being short-term oriented. Short-term profits and unwillingness to invest in human resources and technological tools and equipment almost always causes service quality delivery problems.

Gap 3: Service Quality Specifications vs. Service Delivery

When hospitality managers know what customers expect AND have developed products/services, systems, and specifications to deliver it BUT employees are unable or unwilling to deliver the service, then Gap 3 occurs. Several reasons for Gap 3 are:

1. Employees are not given the tools and working conditions to do the job.

2. Employees are not correctly selected, trained, and motivated.
3. Employees are not properly "led" by managers (Are managers really "leaders?")

Gap 4: Service Delivery vs. External Communications

When hospitality management (represented by marketing and sales executives) promises more in its external communications than it can deliver (operations) then Gap 4 occurs. External communications includes, but is not limited to, advertising, public relations, pricing messages, and personal selling.

Hospitality marketers must ensure that operations can deliver what marketing (external communications) promises. General managers must fully understand the marketing/selling process as well as operational processes. Why? Because it is obvious that the two areas must "seamlessly" work together to meet customer expectations.

Gap 5: Expected Service vs. Perceived Service

Gap 5 is where the "rubber-meets-the-road." The size of Gap 5 is dependent on all of the other gaps.

1. Expected Service is what the customer expects to receive from the hospitality organization.
2. Perceived Service is what the customer believes or perceives that he or she has actually received from the hospitality organization (after the service experience).
3. Gap 5 is the Difference between the above. Customer satisfaction and quality is dependent upon this gap being reduced or eliminated. Hospitality management is responsible for managing the absence or presence of this gap.

2. SERVQUAL Model

Servqual is an instrument for measuring service quality developed by Parasuraman, Zeithaml and Berry in a series of their research on service sectors, this model is also known as Gap. This model is closely related to the satisfaction model.

In the Servqual model, service quality is defined as a global assessment or attitude regarding the superiority of a service (Parasuraman, et al, 1985). The definition is based on three main conceptual bases, namely:

1. The quality of services is more difficult for consumers to evaluate than the quality of goods.
2. Perception of service quality is the result of a comparison between customer expectations and actual service performance.
3. Quality evaluation is not only carried out on service results, but also includes evaluation of the service delivery process.

The groundbreaking work of Parasuraman et al. is the foundation for the SERVQUAL approach to assessing service quality. The model describes how a consumer determines the service quality by contrasting the expected and perceived services.

Service = Service expectations – Service perceptions

The outcome from the comparisons can be categorised into confirmed or met expectations, unmet expectations, and exceeded expectations. The following are the perceptions of service quality:

1) Satisfactory: If the expected service meets the service delivery, customers are satisfied. Hence, the customers are happy as surplus or deficit is not present in the situation.

2) Poor: Customers have a poor perception when their expectations are not fulfilled. The expected service is not matched by the perceived service.

3) Surplus: An excellent service quality exceeds customer expectations. The evaluation is the foundation of this model.

Before beginning the measurement process, one must ensure that one comprehends what is being measured. When comparing anticipated and perceived service, it is critical to determine the measure utilised in the expected service that will serve as the foundation for the comparison. Customers evaluate service excellence using five primary dimensions, namely reliability, responsiveness, assurance, empathy, and tangibles.

The SERVQUAL tool is designed to assess customer expectations and perceptions of the five service dimensions. Two perception scores are compared to two customer expectations scores. The discovered gaps are pooled in order to generate a service quality composite score. These dimensions, which are also known as SERVQUAL dimensions, were discovered by the designers to represent the important dimensions of service quality. The dimensions are detailed below.

i. Assurance

It encompasses personnel's expertise, competency, courtesy, and capacity to instil confidence and trust in the consumer in the service company. Competency is defined as the presence of the necessary knowledge and skills to provide the service. Courtesy entails contact staff is courteous, respectful, friendly, honest, and trustworthy.

ii. Tangibles

The appearance of the equipment, physical facilities, employees, and communication materials are examples of tangibles. The physical

facilities of the organization, their equipment, staff appearance, and the appearance of communication materials employed to market their services or products are also included.

iii. Responsiveness

It alludes to the employees' eagerness to assist clients by offering timely service.

iv. Reliability

The company promises that the service will be precise and trustworthy. The service maintains its promises and is provided for the first time accurately.

v. Empathy

The organisation's attention to the consumer is referred to as empathy. The attention should be kind and tailored to the person, encompassing approachability, ease of communication with service providers, and attempts to comprehend the customer's requirements.

3. Critical Incident Model

According to Lovelock et al., a critical incident is a strategy used to extract information on services that "especially dissatisfy or please clients." The data can be gathered by in-house comment cards, such as those seen in hotels or through one-on-one interviews. The facts and opinions acquired from the interviews reveal prevalent issues or compliments heaped on the organisation. Customers are not compelled to respond to anticipated potential issues, as is the case with other qualitative methods of gathering information. Customers are requested to write down the most notable occurrences from the service. Hope and Muhlemann stated that the method is beneficial in several ways:

i. It makes identification easier (if certain service attributes significantly impact customers).

ii. The information collected may be utilised to restructure the service delivery system around the most important quality criteria as viewed by customers.

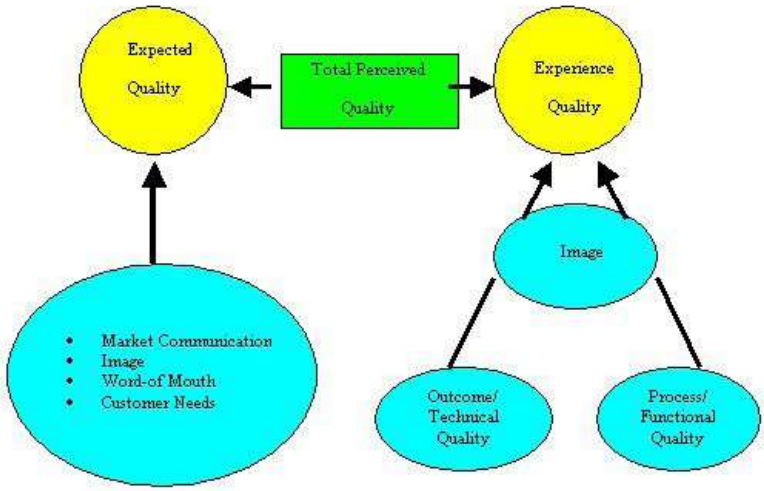
4. Critical Incident Model

In 1982, Christian Gronroos, of the Swedish School of Economic, Helsinki, Finland, introduced The Perceived Service Quality Model (see Figure 1). According to Gronroos, service quality studies and subsequent model development has from the beginning beenbased on what customers perceive as quality. In other words, service quality is an outgrowth of the marketing concept; focus on the customer. What is important is what is perceived as quality by the customer and not what designers or operations people feel is good or bad quality.

Customer buying behavior theories have strongly influenced many service quality models. The notion that the customer's post-purchase perception is a function of his or her pre-purchase expectations is the foundation of the confirmation/disconfirmation concept of service quality. The confirmation/disconfirmation concept is the foundation concept of both Gronroos' 1982, Perceived Service Quality Model and the well-known (1988) Gap Analysis and SERVQUAL models by V. A. Zeithaml, A. Parasuraman, and L. L. Berry (Gronroos, 1991).

According to the Perceived Service Quality model (Figure 1), the quality of a service, as perceived by the customer, is the result of a comparison between the expectations of the customer and his or her real-life experiences. If the "experienced quality" exceeds "expected quality," the "total perceived quality" is positive. If expectations are not met by performance or the actual experience, the perceived quality is

low. There are multiple customers in an internship program: students, internship suppliers, and sponsoring entities, for example. Final success is dependent on initial expectations compared to actual performance.



The Perceived Service Quality Model

Source: Gronroos, C. (1991). "Quality Comes to Service," in The Service Quality Handbook.

5. Service Quality – Evaluation

Consumers consider five factors when assessing service quality: reliability, tangibles, assurance, empathy, and responsiveness. The SERVQUAL model is used to evaluate service quality. The SERVQUAL instrument was developed with the presumption that the definition of service quality is the discrepancy between customer expectations and their evaluation of the service they experienced. Customers are questioned about the level of service they expect from a business in a certain sector in the first part of the questionnaire. Customers are asked to assess the service offered by a specific service provider in the questionnaire's second section.

A customer's perceived level of service is subtracted from the degree of service they anticipate as part of the Gap Theory method for assessing service quality. By using 21 questions, the SERVQUAL methodology evaluates reliability, tangibles, assurance, empathy, and responsiveness. Businesses may use SERVQUAL to gauge customer satisfaction with the quality of their services. For example, if customers consistently give the business low ratings in one area, like assurance, management should work to improve that area of their service offering.

The hospitality industry has a reputation for being short-term oriented. Often, in this fast moving industry, there is a large amount of "fire-fighting" that occurs. When problems arise seem to completely surround the hospitality manager, survival is key. Thus, simply handling the problem and moving to next is the pattern of activity. Long-term planning and serious thought seems to be often overlooked.

Ancient wisdom continuously reminds the human being that, "if you don't know where you are going, any road will take you there" (said the Cheshire Cat to Alice in Through the Looking-glass by Lewis Carroll written in the 1800s). The same can be said for effective planning and implementation by circumspect hospitality leadership. The hospitality industry offers products and services that are often "me-toos" and similar to undifferentiated commodities such as salt or gasoline. Anybody can spend the money to build a beautiful hotel, but not everybody can produce superior service quality. And, meeting customers' expectations, as we have seen above, translates into service quality.

Those hospitality organizations that deliver service quality escape the "commoditization" of the hospitality industry: they "stand-out" from their competitors. This differentiation leads to competitive

advantage as well as other benefits. Some major benefits of delivering service quality are:

1. Retaining Customers – This means "repeat business."
2. Referrals – Satisfied customers are happy to generate positive word-of-mouth.
3. Avoidance of "Price" Competition – If your organization is seen by customers as the same as others, then your product/service is essentially undifferentiated or like a commodity. As mentioned above, Differentiation is a strategy upon which to effectively compete. Price strategy is another way to compete, however this may not always be possible or desirable. Attaining service quality allows competition based on a differentiation strategy
4. Retention of Good Employees – Employees like to work for a "quality" organization.
5. Reduction of Costs – When quality is achieved, costs of correcting problems (after they have occurred) is reduced. Since a focus on quality stresses preventative maintenance, then these costs are reduced. Of course, many other costs are reduced such as lowing employee turnover and the cost of having to motivate uninspired employees (Kotler, Bowen, and Makens, 1996, pp. 362 - 364).

6. Problems with SERVQUAL

Managers should be aware of potential problems with SERVQUAL and the Gap Theory approach it is based on, despite the fact that it is an efficient instrument for evaluating service quality. Service organisations may be able to prevent data misinterpretation and the development of poor marketing strategies by being aware of these issues. There are three potential issues with the SERVQUAL instrument.

First, SERVQUAL assesses customers' of an ideal company in a specific service sector. The expectation may be pertinent to a specific service company's capabilities, or the range of service companies provide to a customer. Customers could suggest, for instance, that doctors must provide their services at the promised time. Doctors rarely attend to patients according to scheduled hours. No one enjoys waiting over their appointment time. Nevertheless, due to high demand, patients endure it.

The generic nature of SERVQUAL is the subsequent issue. It does not assess variables that could be significant for a certain industry as it is not industry-specific. For instance, on-time arrival is a crucial factor for customers in the airline industry. However, SERVQUAL does not assess customers' perceptions concerning this variable.

The Gap Theory approach utilised to gauge the level of service quality is SERVQUAL's third issue. Customer answers will be biased if consumer expectations are measured after a service has been delivered. A quantifiable gap exists between customers' expectations and the service received if they had a favourable experience as they tend to report lower expectations ratings.

Chapter 4
Product Quality

A. Introduction

The product is an important factor that influences the creation of customer satisfaction. Product quality is an important variable in assessing products to meet customer expectations. According to (Keller, 2009), product quality is everything that can be offered to the market to satisfy a want or need, including goods, physical, services, experiences, events, people, places, property, organizations, information and ideas.

According to (Mowen, 2002), product quality is a characteristic of the product in terms of its ability to meet predetermined and latent needs. According to (Amstrong, 2008), product quality is the ability of a product to perform its function, this includes overall durability, reliability, durability, ease of operation.

According to (Amstrong, 2001), product quality is defined as a customer's overall evaluation of the goodness of the performance of goods or services. According to (Lupiyodi, 2009), product quality is the extent to which the product meets its specifications. According to (Amstrong, 2006), product quality is the overall quality or superiority of a product or service in relation to what customers expect. Based

on the explanation above, it can be concluded that product quality is the ability of a product to meet needs and at the same time provide satisfaction for consumers.

The definition of a product according to Kotler (2009) is anything that can be offered to the market to get attention, be purchased, used or consumed that can satisfy a want or need. Conceptually, a product is a producer's subjective understanding of something that can be offered as an effort to achieve organizational goals through fulfilling consumer needs and activities, in accordance with the organization's competence and capacity as well as market purchasing power.

According to Kotler and Keller (2008), the product is a key element in the overall market offering. Apart from that, products can also be defined as consumer perceptions which are described by producers through their production results (Tjiptono, 2008). Based on the definitions above, a product is defined as a collection of real and intangible attributes, including packaging, color, price, quality and brand plus service and sales reputation.

Prior to achieving the understanding of "what is product quality?", the definition of quality should be focused on firsthand. Defining this word is not a simple task due to the different perceptions of it by various parties. When experts are required to present a definition of quality, various answers may be presented based on what they prefer, as shown in the following list of definitions:

- Fitness for use or purpose
- To perform the correct action for the first time
- To perform the correct action at the correct time
- Determine and identify customer's demands
- Attributes that fulfil the customer's demands and provide fulfilment

- Being free from errors or inadequacy
- Adherence to quality
- Worthiness for money

Dr Joseph Juran's coinage of the simple meaning of quality;

According to Kotler and Armstrong (2008) quality is a characteristic of a product in its ability to fulfill predetermined and latent needs. Meanwhile, according to Garvin and A. Dale Timpe (1990, in Alma, 2011) quality is an advantage possessed by the product. Quality in the consumer's view is something that has its own scope which is different from the quality in the producer's view when releasing a product which is usually known for its true quality.

According to Kotler (2009), quality is defined as the overall characteristics and properties of goods and services that influence the ability to meet stated and implied needs. Meanwhile, according to Tjiptono (2008), quality is a combination of traits and characteristics that determine the extent to which the output can meet the prerequisites of customer needs or assess the extent to which the traits and characteristics meet their needs.

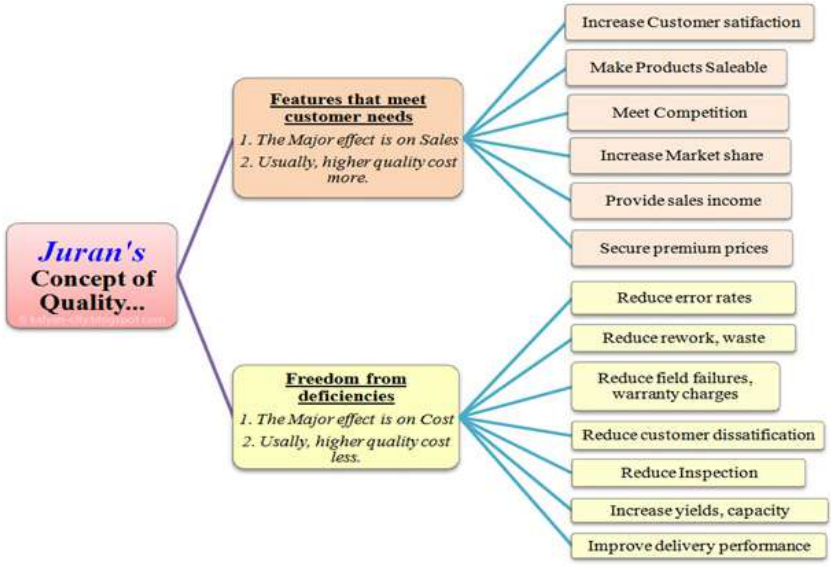
Based on the definitions above, it can be concluded that quality is a product and service that goes through several process stages by taking into account the value of a product and service without any deficiency in the value of a product and service, and produces products and services that meet the high expectations of customers.

Product quality is one of the keys to competition among business actors that is offered to consumers. Consumers always want to get quality products according to the price they pay, although there are some people who think that expensive products are quality products. If the company can implement this, the company will be able to continue to satisfy consumers and increase the number of consumers.

Product quality is an important thing that every company must strive for if it wants its products to be competitive in the market. The existence of a reciprocal relationship between the company and consumers will provide an opportunity to know and understand what the needs and expectations are in consumer perceptions. So, product provider companies can provide good performance to achieve consumer satisfaction by maximizing pleasant experiences and minimizing unpleasant experiences for consumers in consuming products.

To achieve the desired product quality, quality standardization is needed. This method is intended to ensure that the products produced meet predetermined standards so that consumers will not lose confidence in the product in question. Marketers who do not pay attention to the quality of the products offered will suffer consumer disloyalty so that product sales will tend to decline. If marketers pay attention to quality, even reinforced by advertising and reasonable prices, consumers will not think long about purchasing the product (Kotler and Armstrong, 2008).

The easy and well-known definition of quality was presented by Juran, although it does not directly and thoroughly express the definition of quality, which is required by managers who ought to determine the correct measures. To gain an understanding of the concept of quality by Juran, managers should examine the specifications presented in the following figure. Therefore, the meaning of product quality could be the incorporation of attributes with the potential to fulfil customers' demands (wants) and provides fulfilment through the improvement of products (goods) and the elimination of errors or inadequacy.



Product quality is primarily dependent on the following crucial elements:

- The category of raw materials used for the product creation
- The performance of the applied production technologies
- Employees' expertise during the production

- Presence of overheads associated with production, such as water and power supply and transport among others
- Product quality consists of two primary features: measures and attributes

Product quality is continuously developing into a crucial competitive concern. The high dependability of numerous Japanese products has led to reflection among American managers. Despite the interest among managers, an extensive review has not been conducted on the academic literature on quality due to the issue in coverage. In this case, although the scholars in four disciplines (economics, philosophy, operations management, and marketing) have placed the subject into consideration, each group has perceived it from a different viewpoint.

Some surveys presented consumers' displeasure regarding the current quality and service of the products they purchase. Based on current research work on the business units of major North American organisations, managers classified "producing to high-quality standards" as their main concern. Furthermore, philosophy has emphasised definitional concerns; economics, on profit optimisation and market equilibrium; marketing, on the factors of purchase behaviour and customer fulfilment; and the organisation of operations, on engineering applications and manufacturing regulation. As a result, the host of contending viewpoints was recorded following a separate analytical framework and implementation of its respective terminology. At this point, several common themes were recorded, which came with crucial management indications.

On the conceptual front, every discipline has faced these questions: is quality objective or subjective? It is permanent or socially decided? In the empirical sense, interest has highlighted the

correlation of quality. What is the link between cost and quality? Between advertising and quality? Between price and quality? Between quality and market share? In a more general sense, does the increase in quality contribute to more or fewer profits?

B. Definition of Product Quality

Improving product quality is generally not difficult but requires seriousness and ongoing attention, and requires commitment from every individual in the manufacturing company, from the person cleaning the floor to the senior manager. Specific steps that can improve quality include:

a. Communicate the importance of quality, the role of each employee in achieving and maintaining appropriate quality, and employee performance expectations.
b. Maintain a clean and dry (not damp) work area, including storage and shipping areas.
c. Select and use the right equipment for each cutting and sewing/assembly step.
d. Provide proper tools and training for each worker, and communicate quality management performance expectations/targets.
e. Plan and implement ongoing programs regarding machine maintenance.
f. Establish quality standard agreements with fabric suppliers and find the best suppliers before purchasing, including procedures for defective goods/return of goods that are below quality standards.
g. 100% inspection of all incoming fabrics. Vincent defines quality as consistent increase or improvement or decrease in the variance of characteristics in a product (goods and services) produced in

order to meet specified needs in order to increase the satisfaction of internal or external customers (Susanti, 2006: 16).

Vincent defines quality as a consistent increase or improvement or decrease in the variance of characteristics in a product (goods and services) produced in order to meet specified needs in order to increase the satisfaction of internal customers or external customers (Susanti, 2006: 16). Lupiyoadi (2001:158) states that customers will feel satisfied if the results of their evaluation show that the products they use are of high quality.

Philip Kotler, defines quality in a broader scope, namely: Quality is the overall characteristics and properties of a service product that influence its ability to satisfy stated or implied needs. Philip Kotler (2004,49). The explanation above is clearly a customer-centered definition of quality. Because we can say that a seller has provided quality if the sales product meets or exceeds customer expectations. A company that almost satisfies most of its customers' needs is called a quality company.

Meanwhile, Handi Irawan defines quality as follows: Quality is a global dimension and is relatively insensitive to differences. Handi Irawan (2003, 173). So a product is said to be of quality for someone if the product can meet their needs. The quality of a product is the quality of design and the quality of conformance. Design quality reflects whether a product or service has an intended appearance or appearance (process an intended feature). Meanwhile, suitability quality reflects how far the product or service really fits or conforms to the design intent (confirms to the intent of the design).

According to Boetsh and Denis quoted by Fandy Tjiptono: Quality is a dynamic condition related to products, services, people, processes and environments that meet or exceed expectations.

Kotler and Armstrong (2016:97) product quality is "everything that can be offered to the market for attention, purchase, use or consumption that can satisfy a want or need. Currently, all manufacturers understand the importance of superior product quality to meet customer expectations in all aspects of products sold to the market

Assauri (2015:211) quality is "a statement of the level of ability of a particular brand or product to carry out the expected function". Meanwhile, according to Kotler and Keller (2016: 164) product quality is 10 "the ability of an item to provide results or performance that match or even exceed what customers want".

Wijaya (2015:24) product quality is "the entire combination of product characteristics resulting from marketing, production engineering and maintenance which makes the product usable to meet customer or consumer expectations".

Maramis (2018:18) product quality is "the ability of a product to perform its function, this includes overall durability, reliability, accuracy, ease of operation, and product repair as well as other product attributes". Kasmir (2015:63) a product or service is "something offered to consumers to get attention, to own, use or consume in order to fulfill the customer's needs and desires".

The above opinion can be interpreted to mean how much the quality provided in relation to the product and its supporting factors meets the expectations of its users. It can be interpreted that the more it meets consumer expectations, the higher the quality of the product.

In other words, even though according to the producer, the goods they produce have gone through fairly good work procedures, but if they are still not able to meet the standards required by consumers, then the quality of the goods or services produced by the producer is still considered to be of low quality.

Apart from having to be able to meet the standards required by consumers, the quality of the goods produced can also be seen from the consistency of meeting people's expectations and needs. This statement emphasizes that quality should be assessed periodically and continuously so that there is consistency in meeting the standards above.

Every activity carried out must have a goal to be achieved, apart from achieving the goal effectively and efficiently, it is also always oriented towards a result that has good quality. The word quality has many different definitions and varies from conventional to strategic. The definition put forward by (Goetsh and Davis 1994 in Tjiptono 2000) is that quality is a dynamic condition related to products, services, people, processes and environments that meet or exceed expectations.

In the company, the term quality is defined as the factors contained in a product that cause the product to be suitable for its purpose and it is proven that consumers are the ones who determine this main purpose.

According to Kotler and Armstrong (2008) the meaning of product quality is "the ability of a product to perform its functions, it includes the product's overall durability, reliability, precision, ease of operation and repair, and other valued attributes" which means the ability of a product in performing its function, it includes the overall durability, reliability, accuracy, ease of operation and repair of the product as well as other product attributes.

Based on the explanation above, it can be concluded that product quality is the totality of goods and services related to consumer desires whose product excellence is worthy of being sold according to customer expectations.

Product quality is formed by several indicators, including ease of use, durability, clarity of function, diversity of product sizes, etc. (Zeithalm, 1988 in Kotler, 2009).

The definitions and meanings of product quality from several book sources, there are:

- Kotler and Armstrong (2012), product quality is the ability of a product to perform its function, this includes overall durability, reliability, accuracy, ease of operation, and product repair, as well as other product attributes.
- Nasution (2005), product quality is a dynamic condition related to products, people/labor, processes and tasks, and the environment that meets or exceeds consumer expectations.
- Tjiptono (2012), product quality is the expected level of quality and controlling diversity in achieving this quality to meet consumer needs.
- Prawirosentono (2002), product quality is the physical condition, function and characteristics of a product in question which can satisfy consumer tastes and needs according to the value of the money spent.
- Kotler and Keller (2012), product quality is the ability of an item to provide results or performance that match or even exceed what customers want.

Consumers always evaluate the performance of a product, this can be seen from the product's ability to create product quality with all its specifications so that it can attract consumer interest in purchasing the product. Based on the discussion above, it can be said that the quality provided by a product can influence consumer purchasing decisions regarding the products offered.

According to Kotler and Armstrong (2008) quality is a characteristic of a product in its ability to fulfill predetermined and latent needs. Meanwhile, according to Garvin and A. Dale Timpe (1990, in Alma, 2011) quality is an advantage possessed by the product. Quality in the consumer's view is something that has its own scope which is different from the quality in the producer's view when releasing a product which is usually known for its true quality.

According to Kotler (2009), quality is defined as the overall characteristics and properties of goods and services that influence the ability to meet stated and implied needs. Meanwhile, according to Tjiptono (2008), quality is a combination of traits and characteristics that determine the extent to which the output can meet the prerequisites of customer needs or assess the extent to which the traits and characteristics meet their needs.

Based on the definitions above, it can be concluded that quality is a product and service that goes through several process stages by taking into account the value of a product and service without any deficiency in the value of a product and service, and produces products and services that meet the high expectations of customers.

To achieve the desired product quality, quality standardization is needed. This method is intended to ensure that the products produced meet predetermined standards so that consumers will not lose confidence in the product in question. Marketers who do not pay attention to the quality of the products offered will suffer consumer disloyalty so that product sales will tend to decline. If marketers pay attention to quality, even reinforced by advertising and reasonable prices, consumers will not think long about purchasing the product (Kotler and Armstrong, 2008).

According to Kotler and Armstrong (2008) the meaning of product quality is "the ability of a product to perform its functions, it includes the product's overall durability, reliability, precision, ease of operation and repair, and other valued attributes" which means the ability of a product in performing its function, it includes the overall durability, reliability, accuracy, ease of operation and repair of the product as well as other product attributes.

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C. Product Quality Evaluation

Product quality is an important thing in determining the choice of a product by consumers. The product offered must be a product that has really been well tested regarding its quality. Because for consumers the priority is the quality of the product itself.

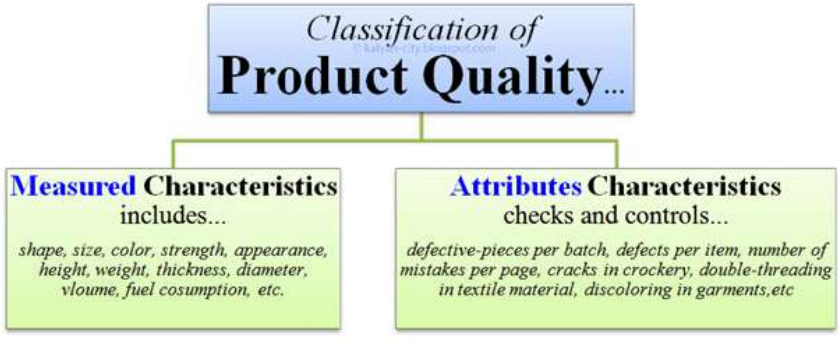
Product quality is the overall characteristics, characteristics and specifications of a good or service that depend on its ability to meet consumer needs. Consumers will prefer and choose products that

have better quality when compared to other similar products that can fulfill their needs and desires.

Product quality is primarily based on several crucial elements, which include the focus on customers. In this case, a category of factors considered by customers was agreed on by previous researchers, with the most prominent factors as follows:

- The category of raw materials involved in the product creation
- What is the performance of the application of various production approaches?
- Employees' expertise in the production
- Presence of overheads associated with production, which includes energy supply, water, and transportation among others
- Product quality comprises two primary attributes: measured features

Product quality consists of two primary attributes: measured and attributes.



A measured characteristic consists of attributes including the product size, shape, strength, colour, height, appearance, weight, diameter, thickness, fuel consumption, and volume among others. Furthermore, attribute characteristics examine and manage the

defective pieces in each batch, errors for each item, amount of errors on each page, breaks in crockery, discolouration in fabrics, and double-threading in textile material among others. Accordingly, provided that products could be classified into good and bad products, product quality denotes the overall product goodness. The five primary factors of product quality are presented as follows:

1. Design quality: The product should be created based on the consumers' demands and superior quality.
2. Quality adherence: The complete products should adhere (match) to the product design requirements.
3. Reliability: The products should have dependability. In this case, the products are not supposed to break or lose their functionality nor need to be repaired frequently. It should be operative for a longer period to show its reliability.
4. Safety: The end product should be secure for use and/or management and should not be harmful to customers in any manner.

5. Proper storage: The product requires proper packaging and storage, with the quality being retained until its expiry date.

According to Tjiptono (2008), quality reflects all dimensions of product offerings that produce benefits for customers. The quality of a product, whether in the form of goods or services, is determined through its dimensions. The dimensions of product quality according to Tjiptono (2008) are:

1. Performance, related to the basic operating characteristics of a product.
2. Durability, which means how long or how old the product in question lasts before the product must be replaced. The greater the frequency of consumer use of a product, the greater the product's power.
3. Conformance to specifications, namely the extent to which the basic operating characteristics of a product meet certain consumer specifications or no defects are found in the product.
4. Features are product characteristics designed to enhance product function or increase consumer interest in the product.
5. Reliability, is the probability that the product will work satisfactorily or not within a certain time period. The smaller the possibility of damage, the more reliable the product is.
6. Aesthetics (aesthetics), related to how the product looks.
7. Perceived quality (impression of quality), is often said to be the result of using measurements carried out indirectly because there is a possibility that consumers do not understand or lack information about the product in question.
8. Serviceability, including speed and ease of repair, as well as the competence and friendliness of service staff.

Then, according to Vincent Gaspersz (2005 in Alma, 2011) the dimensions of product quality consist of:

1. Performance, namely the main operating characteristics of the core product.
2. Additional characteristics or features, namely secondary or complementary characteristics.
3. Reliability, namely the small possibility of damage or failure to use.
4. Conformance to specifications, namely the extent to which the design and operating characteristics meet previously established standards.
5. Durability, which is related to how long the product can continue to be used.
6. Serviceability, including speed, competence, comfort, easy repair, satisfactory complaint handling.
7. Aesthetics, namely the product's appeal to the five senses.

Based on the dimensions above, it can be concluded that a quality dimension is a requirement for a product's value to enable it to satisfy customers according to expectations, while product quality dimensions include performance, aesthetics, features, reliability and also suitability.

According to Arif (2012), there are five levels of product quality, namely:

1. Core benefits. Namely the actual core services or benefits purchased and obtained by consumers. The most fundamental consumer need is benefit, and this is the most fundamental level of a product. A marketer must be able to see himself as someone who provides benefits to consumers. So consumers will ultimately buy the product because of the core benefits it contains.

2. Additional basic benefit. The next level, a marketer must be able to convert the core benefit into a basic product. At the core of the product are the benefits of the basic form of the product or being able to fulfill the basic functions of the product that consumers need, namely functional.
3. Product expectation. It is a series of conditions that are expected and liked by the product attribute. Consumer needs are feasibility. For example, in hospitality services, consumers' expectations are for comfort to rest and eliminate fatigue from all the activities they have carried out.
4. The advantages of the product. That is one of the benefits and services that can differentiate the product from competitors. Consumer needs are satisfaction. For example, banking provides a planned savings product, where in this product customers can save and invest their funds while also getting life and health insurance coverage by paying a certain additional premium. The advantages of this product offer are what customers are looking for.
5. The future potential of the product. This means what the future expectations are with this product if there are changes and developments in technology and consumer tastes. Consumer needs are the future of the product. For example, it is easy to pay telephone, electricity, water or other bills.

The product quality perspective is a consumer's perception of the overall quality or superiority of a product or service with the intent that the consumer expects or desires. According to Tjiptono (2012), there are five types of product quality perspectives, namely:

1. Transcendental approach

Quality in this approach can be felt or known but is difficult to define and operationalize. This point of view is usually applied

in music, drama, dance and fine arts. Apart from that, companies can promote their products with questions such as a pleasant place to shop (supermarket), elegance (cars), facial beauty (cosmetics), softness and smoothness of the skin (bath soap), and so on. Thus, it is very difficult for a company's planning, production and service functions to use this definition as a basis for quality management.

2. Product-based approach

This approach considers quality as a characteristic or attribute that can be quantified and can be measured. Differences in quality reflect differences in the amount of some element or attribute that a product has. Because this view is strictly objective, it cannot explain differences in individual tastes, needs, and preferences.

3. User-based approach

This approach is based on the idea that quality depends on the person who perceives it, and the product that most satisfies someone's reference (for example perceived quality) is the highest quality product. The subjective and demand-oriented perspective also states that different customers have different needs and desires, so that quality for someone is the same as maximum satisfaction felt. A person's satisfaction will certainly vary, as will a person's view of the quality of a product. A product that can fulfill one person's desires and satisfaction, may not necessarily fulfill other people's satisfaction.

4. Manufacturing-based approach

This perspective is supply-based and primarily concerns engineering and manufacturing practices, and defines quality as equal to requirements. In the service sector, it can be said that quality is operations-driven. This approach focuses on adapting internally developed specifications, often driven by the goals of increasing

productivity and reducing costs. So what determines quality is the standards set by the company, not the consumers who use it.

5. Value-based approach

This approach views quality in terms of value and price by considering the trade-off between performance and price, quality is defined as affordable excellence. Quality in this perspective is of relative value, so that the product with the highest quality is not necessarily the product with the most value. However, what is most valuable is the product or service that is most appropriate to buy.

According to Prawirosentono (2002), there are several factors that influence product quality, namely:

1. Man. Human resources are the main element that enables the value addition process to occur.
2. Method. This includes work procedures where each person must carry out work in accordance with the tasks assigned to each individual. This method is the best work procedure so that everyone can carry out their duties effectively and efficiently.
3. Machine. Machines or equipment used in the process of adding value to output. Using machines as supporting equipment for making a product allows for various variations in the shape, quantity and speed of the work completion process.
4. Material. The types of raw materials that are processed in production to produce added value into output are very diverse. The diversity of raw materials used will also influence various output values.
5. Size. At each production stage there must be a measure as an assessment standard so that its performance can be assessed at each production stage. The ability of these measurement

standards is an important factor for measuring the performance of all stages of the production process, with the aim of ensuring that the results obtained are in accordance with the plan.

6. Environment. The environment in which the production process is located greatly influences the results or performance of the production process. If the work environment changes, then performance will change too. There are many external environmental factors that can influence the five elements mentioned above so that they can cause variations in work tasks.

D. Five Methods to Define Quality

Five main methods of defining quality were determined, namely (1) the transcendent method of philosophy; (2) the product-based method of economics; (3) the user-based method of economics, operations management, and marketing; and (4) the manufacturing-based and (5) value-based methods of operations administration.

1. The Transcendent Approach

Based on the transcendent perspective, quality represents "innate excellence." Besides being complete and generally identifiable, this term denotes the uncompromising standards and notable success. However, the proponents of this perspective argue that a precise definition of quality cannot be achieved, considering that it is rather a straightforward and impossible-to-analyse property that is recognisable solely through experience. This definition is significantly derived from Plato's discussion of beauty.5 In Symposium, it was highlighted that beauty is among the "platonic forms," making it an undefinable term. Similar to other terms that philosophers regarded to be "logically primitive," beauty and standard could be comprehended only upon an individual's exposure to the series of objects that demonstrate their features.

2. The Product-based Approach

Product-based descriptions of quality were initially present in the economics literature, followed by their incorporation into theoretical models at a fast rate. Notably, early economic studies on quality placed particular focus on durability due to the convenience of translating it into the above framework.8 Considering that durable products offer a stream of services throughout time, strengthened durability indicates a longer stream of services to take place. Therefore, the distinctions in quality could be perceived as distinctions in quantity, which relatively simplify mathematics.

Product-based definitions have considerable differences, in which quality is perceived as an accurate and measurable element. Based on this perspective, the quality differences represent the quantity differences for several ingredients or features of a product.6 Similar to a premium ice cream that contains strong butterfat content, fine rugs contain a significant amount of knots for every square inch. This method provides a hierarchical or vertical dimension to quality, considering that ranking of goods is possible based on the quantity of the desired attribute in the goods. However, a clear ranking could be achieved only when the features are regarded as virtually appealing to all buyers.

Two evident outcomes are present from this method. First, higher quality could be achieved only with a more significant cost. Given that quality indicates the number of features in a product, which require costly production, premium goods will cost higher. Second, quality is perceived as an intrinsic feature of products instead of a matter assigned to them. Provided that quality indicates the availability or unavailability of product features that could be measured, an objective assessment of the product is possible and not limited to preferences on its own.

3. The User-based Method

User-based descriptions begin from the contrasting belief in which quality "lies in the eyes of the beholder." Individual consumers are presumed to express varying demands, and the goods that fulfil most of their demands are perceived to have superior quality. However, this perception is idiosyncratic and strongly subjective. In the marketing literature, it has contributed to the belief of "ideal points", in which the specific combinations of product features offer the highest fulfilment to a specific consumer. Based on the economics literature, quality distinctions are identified through the changes in a product demand curve, while the literature on operations organisation highlighted that the distinctions are made through the "fitness for use" concept.

Two issues are present in the aforementioned concepts. The first issue is practical, addressing the aggregation of a wide range of individual preferences to ensure that significant definitions of quality could be developed at the market level. Meanwhile, the second issue is more essential, highlighting the methods to differentiate between the product features that suggest those that lead to maximum consumer fulfilment.

The solution to the aggregation issue is identified by assuming that premium products fulfil the demand of most consumers. An agreement of views is indicated with the virtual agreement of users regarding the appeal of specific product characteristics. However, this method overlooks the different weights commonly applied to the attributes of quality and the challenges in developing a fair statistical process to aggregate the wide range of preferences. In most cases, these issues have been overlooked by theorists. To illustrate, economists employ specific models in which the market demand curve shows the response to the shifts in quality without elaborating the derivation of the curve, which summarises individual preferences.

A more essential issue with the user-based method is its quality equation with the highest fulfilment. Despite the relationship between the two, they are not similar. A product that offers the highest fulfilment is more appealing to the party that fulfils lesser needs, although it does not necessarily indicate that it is better. In most cases, implied equivalence is broken down into practice. Although a consumer may benefit from a certain brand due to its uncommon attribute or taste, other brands may be perceived as premium. Following that, the product objective features are taken into account.

The completely objective attributes could also be exposed to various interpretations. Currently, durability is perceived as a crucial factor of quality. In general, long-lived goods are more appealing to those that are worn out at a faster rate. This fact is not true in all cases until the late 19th century when long-lasting products were initially owned by the poor, considering that people with wealth were able to spend on delicate products that often needed to be replaced or repaired. The outcome is a long-established relation between resilience and inferior quality, a viewpoint that changes solely with the mass creation of luxury items, which was enabled by the Industrial Revolution.

4. The Manufacturing-based Method

User-based descriptions of quality involve subjective factors, considering that they are based on what is preferred by consumers, specifically the factors of demand. On the other hand, manufacturing-based descriptions emphasise the equation supply, specifically the engineering and manufacturing practices. All manufacturing-based definitions virtually define quality as "conformance to requirements". Upon the establishment of a design or specification, any divergence indicates a decrease in quality.

Excellence is associated with fulfilling the requirements and "making it right the first time." These terms indicate that a properly developed Mercedes is a premium automobile, considering that it is a properly developed Chevette. Although this method acknowledges the consumer's attention to quality, a product that drifts away from the requirements is possibly not well made nor dependable, which offers less fulfilment compared to a product that is well made, where its main emphasis is internal. Quality is described in a way that engineering and production regulation is simplified. In the design aspect, reliability engineering is highlighted, while the manufacturing aspect emphasises statistical quality control. Overall, both approaches have been constructed to extract the deviations at a fast rate. In this case, the former conducts an analysis of the product essential factors to identify the probable failure modes and propose alternative designs to increase dependability. Meanwhile, the latter employs statistical methods to determine when a production procedure takes place beyond the permissible limits.

Each of these methods focuses on cost reduction. Based on the manufacturing-based method, the increase in quality, which equals the decrease in the number of deviations, reduces the costs. To illustrate, preventing defects is perceived to involve less cost compared to adjustment or modification. Therefore, companies are presumed to show suboptimal performance, in which they only enhance their expenditures on examination and precaution, test the prototypes with more cautions, or extract more defective elements before they are incorporated into the completely assembled units. In this circumstance, they would observe that the expenditures for rework, scrap, and warranty decline by another significant amount.

5. The Value-based Method

Value-based definitions become a step forward for this idea, which describes the quality in the aspects of cost. Based on this view, a quality product shows its condition at an admissible cost or agreement at an admissible cost. Through this method, regardless of the quality of the shoe creation, a $500 running shoe would not be able to become a quality product due to the low number of buyers found.

A current survey regarding consumers' perspectives of quality in 28 product categories indicated the increase in the prevalence of the value-based view. Components and matters were perceived as the primary quality indicators in several types including clothing, food, beauty products, and personal care, which reflected a product-based method to the subject. Overall, it was concluded that "the suitability of quality to be reviewed and considered in the relation to cost is increasing". However, the challenge in using this method is present in its combination of two associated albeit different concepts. Quality, which measures the degree of excellence, equals value, which measures the worth. The outcome is a hybrid — "affordable excellence" — that does not have adequate and properly specified limits and is challenging to be employed.

E. The Inferences from Various Descriptions

The most current descriptions of quality are under specific categories. The coexistence of these different methods comes with some crucial implications. Specifically, this coexistence assists in explaining the frequently contending viewpoints of quality among the members of the manufacturing and marketing sections. Following that, marketing individuals commonly employ a user-based or product-based method to the subject, in which they perceive that higher quality denotes higher performance, improved features,

and other enhancements that lead to higher cost. Following the individuals' perception of the customer as the arbiter of quality, they perceive the events occurring in the factory as less crucial compared to the events in the field.

Manufacturing individuals commonly employ a different method. In their perspective, quality denotes the adherence to requirements and highlights "performing it exactly on the first time". Considering that they relate low quality to significant degrees of scrap and reworking, these individuals normally have an expectation that quality enhancements reduce costs. Notably, these two perspectives are conflicted, which could lead to severe communication problems. Specifically, remedial initiatives may face paralysis if the concurrence of these contending viewpoints does not receive an acknowledgement. An instance could be the recent review of a large section of a major consumer products organisation on its procedures taken to manage quality. The organisation showed interest in the assessment of its new-product introduction procedure, given that emerging products were perceived as the factor leading to competitive advantage.

Two different perceptions were raised. In this case, a group perceived the process to be considerably successful, in which new products emerged on regular basis, with a low amount of consumer complaints and defective items yet to be distributed to the trade in any high quantity. Another group perceived the necessity for the programme to be improved due to the extremely low quality. In this case, the delay often occurred on the releases of new products while designs went through configuration to adjust to manufacturing specifications. Moreover, material and labour variations of several hundred thousand dollars had taken place due to unprecedented expenditures on scrap and rework. These conflicting views placed a halt on the projects. More developments need the recognition that

one group is applying a user-based description of quality while the other group is applying a manufacturing-based method. At this point, two groups would possibly show agreement regarding the issues they experience.

Despite the possibility of conflict, organisations are required to cultivate different viewpoints, given that they are crucial to an effective initiation of premium products. Furthermore, dependency on a sole description of quality is a factor leading to issues in most cases. For instance, a Japanese paper manufacturer has currently found that its newsprint rolls faced failure in satisfying the customers although they fulfilled the Japanese Industrial Standard. Although conformance was outstanding and representing the manufacturing-based method to quality, it was poorly accepted. However, no customer complaints were revolving around other rolls of newsprint despite the failure to fulfil the standard. Meanwhile, a different situation took place for a leading U.S. manufacturer of room air conditioners, in which its products had positive acceptance by the customers and high ratings by Consumer Reports. In spite of this, severe losses occurred due to the extreme reject, scrap, and warranty costs. While the product design was in line with the customers' demands, the company was significantly impacted by the failure in proceeding with strict adherence to manufacturing.

Overall, the aforementioned phenomena indicated the importance of rapidly shifting one's method to quality upon the transition of products from design to market. The features that suggested the quality should be determined mainly through market research (a user-based method to quality). Following that, translation of these features into recognisable product characteristics should be made (a product-based method to quality) and the manufacturing procedure should be managed to guarantee that the products are

created based on the requirements (a manufacturing-based method to quality). On the other hand, the process that overlooks any of these stages would not contribute to the creation of a quality product. These three viewpoints are important and should be refined.

A common issue is present in every crucial method to quality, which could be ambiguous and inaccurate in terms of elaborating the essential factors of product quality. Considerably small number of analysts except for Juran and Maynes paid attention to these details, which was not an ideal condition, given that numerous matters could be learnt by applying a less homogenous way of treating quality.

F. Eight Dimensions of Product Quality

Eight dimensions could be determined as the framework when the essential factors of product quality are considered:

- ✓ Performance,
- ✓ Attributes,
- ✓ Dependability,
- ✓ Adherence,
- ✓ Resilience,
- ✓ Usability,
- ✓ Attractiveness,
- ✓ Perceived Quality.

Every factor is complete and unique, given that a product could gain a high ranking on one dimension while having a lower ranking on another dimension.

1. Performance

Performance denotes the main operating features of a product. For an automobile, this factor includes several attributes such as

handling, acceleration, comfort, and cruising speed. A television set comprises image and sound clarity, colour, and capability to gain distant stations.

Quality dimension is a combination of the factors of the product and user-based methods. With the involvement of measurable product features, brands could obtain objective ranking on a minimum of one dimension of performance. However, the link between quality and performance holds a higher level of ambiguity. Individual preferences commonly determine the perception of performance differences as quality differences. Users normally exhibit diverse demands and interests, which are possibly equal to the quality with high performance in their field of prompt interest.

The link between quality and performance is also influenced by semantics. Some of the words that demonstrate product performance include terms with frequent association with quality and terms that are not able to take on the relation. For instance, a 100-watt light bulb offers stronger candlepower (performance) compared to a 50-watt bulb, although a small number of consumers would perceive this distinction as an indicator of quality. In simple words, the products fall under separate performance categories. However, the quietness and smoothness of an automobile ride are commonly regarded as a direct quality indication. Thus, silence is a performance dimension that is interpreted into quality, although this action is not applied to candlepower. These distinctions represent the conventions of the English language, which are in line with personal preferences.

2. Attributes

The same method could be employed for product features as the second quality dimension. Attributes denote the "bells and whistles" of goods, which are the secondary features that complement the

essential purpose of the product. Examples are free drinks on a plane flight, permanent press, automatic tuners on a colour television set, and cotton cycles on a washing machine. In many cases, drawing the line that separates primary goods attributes (performance) from secondary attributes (features) is challenging. Similar to product performance, attributes comprise measurable and objective attributes, in which their translation into quality differences receives the same impact from individual preferences. The main difference between the two is one of the centrality or level of significance to the user.

3. Dependability

Reliability is the third quality dimension that represents the possibility of a product failure in a designated time. The most typical measures of dependability include the failure rate for each unit time, mean time between failures (MTBF), and mean time to first failure (MTFF). Considering that these measures involve the use of a product for a certain time, they contain more relevance to durable goods compared to products and services that go through instant consumption. It is common for Japanese manufacturers to place emphasis on this quality dimension and employ it to achieve a competitive edge in the copying machine industries, semiconductor, automotive, and consumer electronics.

4. Adherence

An associated quality dimension is adherence or the level to which the depiction and operating attributes of goods adhere to the pre-established standards, which also involve internal and external factors. In the factory, the measurement of conformance is typically conducted through the occurrence of deficiencies, in which the portion of all units needs a rework or repair due to failure in meeting the requirements. In the field, extracting the information related

to conformance is often challenging, which also involves the use of proxies. Two typical measures include the occurrence of service calls for goods and repairs under warranty. However, these measures also overlook other variations from the standard through the misspelling of labels or poor-quality construction that does not contribute to service or repair. Therefore, more thorough measures of conformance are needed during the calculation of these items.

Dependability and adherence are strongly related to the manufacturing-based method to quality. Enhancements in both measures are commonly perceived as a direct translation into quality gains, considering that deficiencies and field collapse are virtually considered unappealing by all customers. Therefore, these elements are considerably objective quality measures, which have a low possibility to represent individual preferences compared to rankings following the performance or attributes.

5. Resilience

Resilience, which measures the goods lifespan, comprises technical and economic dimensions. Practically, resilience could be described as the product use before its physical deterioration takes place. An ideal example is present through a light bulb, in which the filament would be burning up after long hours of use, making the replacement of the bulb necessary. However, the bulb cannot be repaired. These products are described by economists as "one-hoss shays," which have also been used substantially to model the production and consume capital goods.

Interpreting the durability becomes more challenging when repair could be performed. The concept involves a supplementary dimension, given that product life would change based on the changes in economic conditions. Durability denotes the product used by an

individual before it loses its function and replacement is preferred over a repair. A sequence of choices is present for consumers. Specifically, when failure of a product takes place, the predicted cost should be measured in dollars and the personal trouble of succeeding repairs against the investment and operating expenditures of a newer and more dependable model. In this case, goods lifespan is influenced by losses due to downtime, repair costs, personal evaluation of inconvenience and time, relative costs, and other economic factors through the condition of elements or matters. This method of resilience comprises two crucial inferences. To be specific, it is suggested that reliability and durability are strongly related. A product with frequent failure has the likeliness to be scrapped earlier compared to a more dependable product. This situation increases the repair cost while buying a new model would be more appealing. This method also indicates that careful interpretation should be made on durability figures.

Additional goods lifespan may not be attributed to technical enhancements or the application of matters with a longer lifespan. However, a change in the underlying economic environment is possible. To illustrate, the predicted life of an automobile has constantly increased over the previous decade, which amounts to 14 years on average. Older automobiles are retained for a longer time, which accounts for a higher percentage of all used cars. The increase in gasoline costs and a fragile economy are some of the elements perceived to lead to these changes, which have led to a lower average number of miles driven annually and federal regulations ruling gas mileage. These factors have reduced the size of new models and increased the appeal to numerous customers in maintaining older cars. In this situation, environmental changes have led to reports of increased durability in many cases.

6. Usability

The sixth quality dimension is the speed, usability, and capability of repair. The dysfunctionality of a product is not the sole concern among consumers, but also the elapsed period prior to restoration of service, the opportunity with which service appointments are maintained, the condition of their dealings with service staff, and the occurrence of the failure faced by service calls or repairs to determine the solution to exceptional issues. Considerably objective measurement could be performed on several factors, while others represent the contrasting personal standards of the service that is accepted. To illustrate, a current research work on consumer satisfaction with professional services recorded strong dissatisfaction with the statements "the service was offered in a negligent manner without any professionalism" and "I think I was being regarded as an object instead of a person". Overall, these comments demonstrate the subjective perceptions of what behaviour that is deemed professional and permissible.

More objective assessments could be conducted on other factors of service. The measurement of responsiveness is conducted through mean time to repair (MTTR), while technical capability is represented through the occurrence of multiple service calls that are important for correcting an issue. Considering that majority of the consumers state that more rapid repair and decreased downtime are equal to more superior quality, these factors of serviceability are less impacted by personal interpretation compared to the factors that involve the assessment of courtesy or standards of professional behaviour. Several organisations have emphasised this quality dimension. Based on Caterpillar Tractor's statement that it would distribute the repair parts at any place in the world in 48 hours and Mercedes' statement of 24-hour (overnight) service in California and Arizona, it is indicated

that even outstanding producers have a belief regarding the value of this method.

7. Attractiveness

The last two quality dimensions hold the highest subjectivity. Notably, the aesthetics and perceived quality have a strong relation to the user-based method. Specifically, attractiveness, which represents the appearance, feel, smell, taste, or sound of a product, is subject to personal discernment and what they prefer. Besides, the marketing notion of "ideal points", which represent the amalgamations of product features that are in line with what is preferred by the specific consumer, was initially created to capture solely this quality dimension.

8. Perceived Quality

Similar to the evaluation of aesthetics, perceptions of quality could be subjective. Considering that consumers do not constantly have the entire data regarding a product features, they have to depend on indirect methods for brand comparison. In these cases, less evaluation would be performed on products in terms of their objective features compared to their images, brand names, or advertising. These conditions could also impact academic judgments. When professors around the nation are required to provide ranking to the departments in their areas based on quality, the only partial explanation is made about the rankings, such as the objective measures as the number of articles made in leading journals by the department members. Both reputations, namely 1) the historical strength of the department and affiliation and 2) the standard of the university where a department is present, are crucial in justifying the rankings.

Overall, the eight primary dimensions of quality encapsulate diverse concepts, with some of the dimensions involving measurable

product features, while other dimensions represent what is preferred by a person. While some are objective and permanent, others evolve with the changes in fashion. Moreover, several dimensions are the intrinsic features of goods, while others are attributed features.

Notably, the wide range of these notions assists in elaborating the distinctions among the five traditional methods of quality. In this case, each method places emphasis on a distinguished quality dimension:

1) The product-based method highlights the characteristics, performance, and strength;
2) The user-based method highlights the attractiveness and perceived quality, and;
3) The manufacturing-based method highlights the dependability and adherence. Conflicts among the five methods are unavoidable, given that each represents the quality from a different viewpoint. Upon the unbundling of the concept, each dimension is regarded separately, while the clarity of the factors of disagreement is achieved.

From several theories above, it can be concluded that product quality can determine customer satisfaction which is related to the customer's own expectations regarding the perceived quality of the product. Meanwhile, according to Stevenson, the dimensions of product quality are as follows:

1) Performance, this is related to the functional aspect of an item and is the main characteristic that customers consider when purchasing the item.
2) Aesthetics, is a subjective characteristic regarding aesthetic values related to personal considerations and a reflection of individual preferences.

3) Special features, namely performance aspects that are useful for adding basic functions, related to product choices and their development.

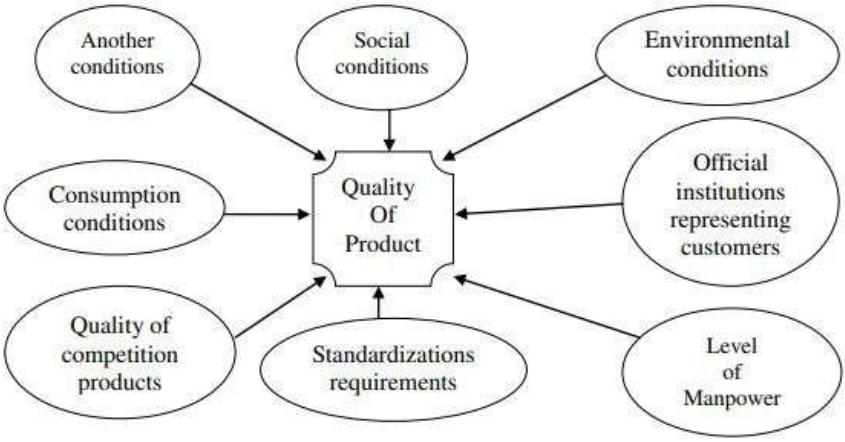
4) Conformance, this relates to the level of conformity to previously determined specifications based on customer wishes.

5) Reliability, this is related to the probability or possibility that an item will successfully carry out its function every time it is used within a certain period of time and under certain conditions.

6) Durability, which is a reflection of economic life in the form of a measure of the durability or useful life of goods.

7) Perceived Quality, related to customers' feelings regarding the existence of the product as a quality product.

8) Serviceability, related to handling after-sales services, such as handling complaints made by customers.



The Factors Forming Quality Products Requirement

Source: Dudek Burlikowsa and D. Szewieczek (2004:204)

Besides that, according to (Tjiptono, n.d.) Product quality dimensions consist of 8, namely:

1. Performance, is related to the main function of a product and is the main characteristic considered by consumers when purchasing a product.
2. Product features are characteristics or additional characteristics that complement the benefits of a product and are related to product choices and development. The features of a product are usually measured and subjective by each individual (in this case the consumer) which shows differences in the quality of a product.
3. Reliability is related to the chance or possibility that an item will successfully carry out its function every time it is used within a certain period of time and under certain conditions. The reliability of a product indicates a level of quality that is meaningful for consumers in choosing a product.
4. Conformance to specifications. This dimension relates to the level of conformity of product performance to predetermined specifications based on consumer desires.
5. Durability. This dimension relates to how long the product can be used for the durability of a product, including economic and technical aspects. Technically, the durability of a product is defined as the number of uses obtained by a person before experiencing a decline in quality. Meanwhile, economically, durability is defined as the economic life of damage and the decision to replace the product.
6. Ability to be repaired (serviceability). Serviceability relates to the speed, competence, usability and ease of a product to be repaired.

7. Aesthetics. Aesthetics is a subjective characteristic regarding aesthetic values related to personal considerations and a reflection of individual preferences. The aesthetics of a product are seen through how the product sounds to consumers, how the product looks, tastes and smells. Aesthetics also concerns the appearance of a product that can make consumers like a product.
8. Perceived quality. This dimension relates to consumer assessments of images, brands or advertising.

Well-known branded pliers products are usually perceived to be of higher quality compared to less well-known brands.Indicators that can measure Product Quality according to (Daulay, 2017) include:

1. Conformity to specifications
2. Features
3. Aesthetics
4. Quality impression

The quality of a product, whether in the form of goods or services, needs to be determined in its dimensions. If a company wants to maintain its competitive advantage in the market, the company must understand what dimensional aspects are used by consumers to differentiate the products the company sells from competitors' products.

According to Riyono (2016:99) the dimensions of product quality, there are:

1. Performance, related to the basic operating characteristics of a product.
2. Durability, which means how long or how old the product in question lasts before the product must be replaced. The greater

the frequency of consumer use of a product, the greater the product's durability.

3. Conformance to Specifications, namely the extent to which the basic operating characteristics of a product meet certain consumer specifications or no defects are found in the product.
4. Features are product characteristics designed to enhance product function or increase consumer interest in the product.
5. Reliability, is the probability that the product will work satisfactorily or not within a certain time period. The smaller the possibility of damage, the more reliable the product is.
6. Aesthetics, related to how the product looks, can be seen from the appearance, taste, smell and shape of the product.
7. Perceived Quality, is often said to be the result of using measurements carried out indirectly because there is a possibility that consumers do not understand or lack information about the product in question.

Meanwhile, according to Lupiyoadi and Hamdani (2015: 176), the dimensions of product quality are as follows:

1. Performance. Performance here refers to the character of the core product which includes the brand, attributes that can be measured, and aspects of individual performance. The performance of some products is usually based on subjective customer preferences which are basically general in nature.
2. Product Diversity (Features). Can be in the form of additional products from a core product that can add value to a product. Product diversity is usually measured subjectively by each individual (in this case consumers) which shows differences in the quality of a product.

3. Reliability. This dimension is related to the possibility of a product experiencing a malfunction during a certain period. The reliability of a product that provides a level of quality is very important for consumers in choosing a product.
4. Conformance. Another dimension related to the quality of a product is the conformity of the product with standards in the industry. The suitability of a product in the service industry is measured by the level of accuracy and completion time, including calculating errors that occur, unanticipated delays and several other errors.
5. Durability. The measure of a product's durability includes both economic and technical aspects. Technically, the durability of a product is defined as the number of uses a person obtains before experiencing a decline in quality. Economically, durability is defined as the economic life of a product seen from the number of uses obtained before damage occurs and the decision to replace the product.
6. Service Capability (Servicebility). Service capability can also be referred to as speed, competence, usability and ease of product repair. This dimension shows that consumers not only pay attention to a decrease in product quality but also the time before the product is stored, scheduling, service, communication processes with staff, frequency of repair services for product damage, and other services.
7. Aesthetics, is the most subjective dimension of measurement. The aesthetics of a product can be seen from how the product sounds to consumers, how the product looks, tastes and smells. Thus, aesthetics is clearly an assessment and reflection felt by consumers.

8. Perceived Quality. Consumers do not always have complete information regarding product attributes. However, consumers generally have information about products indirectly, for example through the brand, name and country of manufacture.

Based on the explanation above, it can be concluded that attributes are product elements that are considered important by consumers and are used as a basis for purchasing decisions. As well as the requirements for a product's value to be able to satisfy customers according to expectations, the dimensions of product quality include performance, aesthetics, features, reliability and suitability.

If a company wants to maintain its competitive advantage in the market, the company must understand what dimensional aspects are used by consumers to differentiate the products the company sells from competitors' products. Quality reflects all dimensions of product offerings that produce benefits for customers.

According to Sopiah and Sangadji, (2016:80) product quality consists of several indicators, namely:

a. Performance, is an element of product quality that is directly related to how a product can carry out its function to meet consumer needs.
b. Reliability, is the product's durability during consumption.
c. Features are secondary functions added to a product.
d. Durability, shows a measurement of the product cycle, both technically and in time.
e. Consistent, shows how far a product can meet certain standards or specifications.

f. Design, is an emotional aspect that influences consumer satisfaction so that the packaging design or product shape will also influence the perception of the product's quality.

According to Gaspersz (2008), the dimensions of product quality are as follows:

a. Performance

Performance is the basic operating characteristic of a core product and can be defined as the appearance of an actual product. The performance of a product is a reflection of how a product is presented or displayed to consumers. Performance measurement levels basically refer to the level of basic characteristics that the product operates at. A product is said to have good performance if it meets expectations. For each product/service, the performance dimensions can be different, depending on the functional value promised by the company. For the food business, the performance dimension is good taste.

b. Reliability

Reliability is the level of difficulty of a product or the consistency of a product's reliability in its operational process in the eyes of consumers. Reliability of a product is also a measure of the possibility that a product will not be damaged or fail within a certain period of time. A product is said to have high reliability if it can attract consumer trust regarding the quality and reliability of a product. The dimensions of performance and reliability are almost the same at first glance but have clear differences. Reliability shows the probability of the product carrying out its function.

c. Additional privileges (features)

Features are secondary or complementary characteristics and can be defined as the level of completeness of the attributes of a product. At a certain point, the performance of each brand is almost the same but the difference lies in the features. This also results in consumer expectations regarding performance dimensions being relatively homogeneous and expectations regarding features being relatively heterogeneous.

d. Conformance to specifications (conformance to specifications)

Conformity is the extent to which design and operating characteristics meet predetermined standards and can be defined as the degree to which all units produced are identical and meet promised target specifications. The definition above can be explained that the level of conformance of a product is said to be accurate if the products marketed by the manufacturer are in accordance with the company's plans, which means they are products that the majority of consumers want.

e. Durability

Durability is related to how long the product can continue to be used and can be defined as a measure of the expected operating life of the product under normal conditions. This dimension includes technical life and economic life. The greater the frequency of consumer use of a product, the greater the product's durability.

f. Ability to serve (service ability)

Service capability includes speed, competence, comfort, easy repair, and satisfactory complaint handling and can be defined as a measure of the ease of repairing a damaged or failed product. This means that if a product is damaged or fails, the readiness to repair

the product can be relied upon, so that consumers do not feel disadvantaged.

g. Aesthetics

Aesthetics is the beauty of a product to the five senses and can be defined as the attributes inherent in a product, such as color, model or design, shape, taste, aroma and so on. Basically, aesthetics are elements that complement the basic function of a product so that the performance of a product will be better in front of consumers.

h. Perceived quality

Perceived quality is the consumer's perception of the overall quality or superiority of a product. Usually, due to the buyer's lack of knowledge about the attributes or characteristics of the product to be purchased, the buyer perceives its quality in terms of price, brand name, advertising, company reputation and country of manufacture.

According to Tjiptono (2008), quality reflects all dimensions of product offerings that produce benefits for customers. The quality of a product, whether in the form of goods or services, is determined through its dimensions. The dimensions of product quality according to Tjiptono (2008) are:

1. Performance, related to the basic operating characteristics of a product.
2. Durability, which means how long or how old the product in question lasts before the product must be replaced. The greater the frequency of consumer use of a product, the greater the product's power.
3. Conformance to specifications, namely the extent to which the basic operating characteristics of a product meet certain consumer specifications or no defects are found in the product.

4. Features are product characteristics designed to enhance product function or increase consumer interest in the product.
5. Reliability, is the probability that the product will work satisfactorily or not within a certain time period. The smaller the possibility of damage, the more reliable the product is.
6. Aesthetics, related to how the product looks.
7. Perceived quality (impression of quality), is often said to be the result of using measurements carried out indirectly because there is a possibility that consumers do not understand or lack information about the product in question.
8. Serviceability, including speed and ease of repair, as well as the competence and friendliness of service staff.

Then, according to Vincent Gaspersz (2005 in Alma, 2011) the dimensions of product quality consist of:

1. Performance, namely the main operating characteristics of the core product.
2. Additional characteristics or features, namely secondary or complementary characteristics.
3. Reliability, namely the small possibility of damage or failure to use.
4. Conformance to specifications, namely the extent to which the design and operating characteristics meet previously established standards.
5. Durability, which is related to how long the product can continue to be used.
6. Serviceability, including speed, competence, comfort, easy repair, satisfactory complaint handling.
7. Aesthetics, namely the product's appeal to the five senses.

Based on the dimensions above, it can be concluded that a quality dimension is a requirement for a product's value to enable it to satisfy customers according to expectations, while product quality dimensions include performance, aesthetics, features, reliability and also suitability.

G. The Crucial Significance of Product Quality Dimensions

An acknowledgement of eight dimensions is crucial for crucial reasons. A company could have competition in terms of quality through several methods without having to gain all eight dimensions at the same time. Nevertheless, a segmentation method could be adhered to, with a few dimensions being separated to be focused on. For instance, Japanese manufacturers have made their traditional entry into the U.S. markets by highlighting the adherence and dependability of their products while understanding the quality dimensions. The ideal "fits and finishes" and low repair rates of Japanese automobiles are common, although poor safety records (performance) and low corrosion resistance (strength) are rarely identified. In spite of these demerits, Japanese automobiles have eventually exhibited the highest quality possible for many American consumers. This condition indicates that organisations are able to achieve a considerably narrow quality niche. Besides, no other options are available if competitors have gained notable reputations for brilliance. In this case, new entrants could be capable of solely securing a defensible position upon their focus as a still untapped dimension of quality.

It is clear that this pattern is suitable for the piano industry. Steinway and Sons had been good leaders for many years; its tools are common for the smooth voicing (the smoothness of character and timbre of each of the 88 notes on the keyboard), the pleasantness of their registers (the

round and soft tone throughout the entire range of piano), tone duration, their perfectly polished woodwork, and long lives. Furthermore, every piano is made using handcraft, which exhibits distinguished style and sound. In spite of these positive features, Steinway has currently been contended by Yamaha, a Japanese manufacturer that has established a solid status for quality in a considerably short period. This action was performed by Yamaha through dependability and adherence, two quality dimensions that are on the bottom of Steinway's list instead of artistry and distinctiveness.

Notably, among Yamaha's main advantages include the same sounds produced through all pianos. Both organizations receive high profits in spite of the diverse methods of quality. This situation indicates the significance of thoroughly aiming for one's quality niche, although the choice of a defensible niche is merely the first stage. Moreover, operational conditions should also be fulfilled, considering that every quality dimension involves its demands on the organization. High-efficiency needs thorough attentiveness to the design and strong staff for it, while superior strength involves lasting or "derated" factors and close collaboration between the purchasing and engineering sections. To gain high adherence, the written conditions and accuracy in the assembly are required, while exceptional serviceability needs active field representatives and a solid customer service department. In every case, a different function gains the lead role, while various initiatives toward success are needed.

Clear managerial implications are present in this analysis: after the selection of the dimensions of quality where competitiveness is expected, an organization should adjust its arrangement and operations to fulfil the specified requirements. In other cases, the incorrect sections may be raised in terms of status or the incorrect

tasks would be received. The disaggregation of the notion of quality enables organizations to determine these operating specifications in line with their aim to the untapped markets.

Product quality is the main element that business actors need to pay attention to. Especially for those who really want to maintain their business amidst fierce competition and even make the business more advanced and developed. However, of course this is not an easy matter.

The definition of good product quality must first be understood, so that business actors understand what kind of quality can be considered good, how to achieve it, what needs to be done to maintain that level of quality, and what will happen if these efforts fail. Even though it may sound troublesome and requires a lot of effort, maintaining the quality of every product or service you are trying to market will provide enormous benefits for business operations and development.

Product quality is the ability of a product or service to carry out its function by considering various aspects such as its reliability, durability, convenience value, need for repair, and other values that also need to be considered. From this understanding alone, business actors can estimate what efforts need to be made to ensure quality is always maintained.

According to experts, product quality has more or less the same meaning. Kotler and Armstrong, for example, understand quality as the ability of a product to perform its function, and this measure includes overall durability, reliability, accuracy, ease of operation, product repairability, and also other product attributes. From these two definitions, there are similar points of consideration that every business actor needs to pay attention to:

a. Product Durability or Durability

Regarding product quality, what is meant by durability is the resistance that the product has when used. The longer the period of use of a product, it could be said that the quality is also better.

By ensuring that the product to be marketed has good durability during use, business actors can add selling value to the product. Because, whether they realize it or not, consumers will be happier with products that have a longer shelf life than similar products that are easily damaged. Product quality with a long life cycle will convince customers to make repeat purchases, for example buying the same product when the previous product has expired and cannot be used anymore.

However, business actors must also pay attention to the nature of the product they want to market before increasing its durability. For products that are only used once, durability should not be something that needs to be considered in depth. If this is the case, improving product quality from the other side can be an option.

b. Product Reliability or Reliability

The next measure of product quality that needs to be considered after ensuring durability is the reliability of a product. For this measure, business actors must see how precisely the product being marketed carries out its functionality. Frying products, for example, can be said to have good reliability if they can be used to fry food evenly; not cooked in one part, but in other parts it is actually burnt or still too raw.

Remember that consumers' goal in buying a product is to solve the problems they face in their daily lives. Therefore, the level of reliability as a measure of product quality is one thing that needs to

be considered as best as possible. Consumers will not buy products that are unreliable.

In contrast to durability, which requires different needs depending on the nature and type of product, product quality in terms of reliability is a very important element and cannot be underestimated, because each product must be able to be used according to its function; regardless of the nature or type of product itself. Products with a high level of reliability will also be easier to market by word of mouth so that by ensuring the reliability of a product, sales figures can also be increased optimally.

c. Ease of Product Operation

Product quality can also be seen from how easy the product is to use. So, apart from durability and reliability, business actors also need to pay attention to whether the products that will be or are being marketed are easy for customers to use or not.

Sometimes, ease of use clashes a little with the beauty or aesthetics of the product. It's good if a product is made beautifully and the quality of the product is good. However, if you really have to choose one, make sure to prioritize the ease of use of the product over the beauty of its shape.

In contrast to food which can increase a person's appetite if it has a beautiful and appetizing presentation, sometimes customers don't really care about the shape of the product used as long as they don't experience hassles or other problems when operating it. This does not mean that the aesthetic side of the product being marketed is not important; Of course, the appearance of a product is also an important element in attracting customers to buy it, but the level of urgency is not that high compared to the ease of use.

Also look at the target market you want to target with the product. Product quality can also be adjusted to its market share. For example, products that target young customers whose motor skills may not yet reach peak growth and development need to be designed with ease of use as the main consideration.

Every business actor is advised to prioritize the quality of the products they want to market. Once high quality is achieved, it is not a problem if business actors want to develop products by paying attention to their aesthetic values.

d. Product Repair or Repair

It may sound unreasonable, but product quality not only needs to be maintained during manufacture, for example by designing products that are durable, reliable and easy to use, but also ensuring that the product can get good after-sales service too. In this aspect, ease of product repair or repair is the main star.

It is not uncommon for people to feel confused when they want to buy antique cars even though the car is well-known and has been tested for its quality; both in terms of durability, reliability and ease of use. The main reason is that even though the car has a good product quality, antique cars often cause new problems when they are damaged because there are no longer many suppliers of new year car components.

The same thing can also apply to your business commodities. Product quality must also consider how easy it is to repair the product when the product experiences problems, both problems that have been predicted in advance and problems that are unexpected. Providing special outlets for repairs will help convince customers to buy the product without having to worry about what to do if the product is damaged during use.

Apart from the availability of easily accessible repair places, the price of the components needed during repairs can also be a measure of product quality. Even though there are many official outlets that provide repair services, everything will feel useless if the price of the repair itself is too high and not commensurate with the functions offered by the product concerned.

If this product quality measure is not properly considered, customers will quickly turn to competitors who provide similar products with more affordable after-sales service. Just imagine, of course no one would want to buy a product if the cost of repairing that product was as high as the cost of getting a new product, right? Users will quickly turn away and be reluctant to make repeat purchases if this situation occurs, so business actors need to pay close attention to this.

e. Other Product Attributes

Apart from the product qualities above, there are still several other aspects that can influence the quality level of each product marketed. For these other attributes, business actors need to provide added value to their products that competitors' products do not have, for example by guaranteeing a positive product image.

Nowadays, it is not uncommon for businesses to install celebrities to build a positive image for their products. It is not uncommon for customers to see celebrities as guarantors of the quality of the products being marketed. The feeling of wanting to own an item that is also used by someone you idolize, for example, can provide additional value to a product that can boost its sales figures.

Other attributes can include the exclusivity value of a product. Even though it is not directly related to the quality of the product, this attribute can be an added value in attracting customers to buy it.

On the other hand, this does not mean that non-exclusive products are of lower value. For some types of products, how widely the product is circulated and how easy it is to find is another added value. This is where the business marketing strategy planning function is needed by business actors to determine the added value they want to pursue in marketing a product.

Paying attention to and maintaining product quality is the main key needed by business actors to ensure their business experiences a good level of growth. Businesses that offer products without clear quality will find it difficult to develop because they cannot attract customers to make purchases.

Besides that, there are benefits quality products (Ariani, 2003):

1. Improve company reputation. A company or organization that has produced a quality product or service will receive the title as an organization that prioritizes quality, therefore, the company or organization is known to the wider community and gets more value in the eyes of the public.
2. Lower costs. To produce quality products or services, companies or organizations do not need to incur high costs. This is because the company or organization is oriented towards (customer satisfaction), namely by basing the type, type, time and quantity of products produced in accordance with consumer expectations and needs.
3. Increase market share. Market share will increase if cost minimization is achieved, because the organization or company can reduce prices, even though quality remains the main thing.
4. International impact. If you are able to offer quality products or services, then apart from being known in the local market,

these products or services will also be known and accepted in the international market.

5. There is product responsibility. With increasing competition for the quality of products or services produced, organizations or companies will be required to be increasingly responsible for the design, process and distribution of these products to meet consumer needs.
6. For product appearance. Quality will make the product or service known, in this case it will make the company that produces the product also be known and trusted by the wider community.
7. Realizing the perceived quality is important. Competition is now no longer a matter of price but rather product quality, this is what encourages consumers to want to buy products at high prices but with high quality.

In terms of the quality of a product produced by a company, there is sometimes variation. This is because the quality of a product is influenced by several factors, where these factors can determine whether a product can meet predetermined standards or not, these factors include:

a. Humans. The role of humans or employees in a company directly influences the quality of the products produced by a company. So the human aspect needs to receive sufficient attention. This attention is done by holding exercises, providing motivation, welfare and so on.
b. Management. Responsibility for product quality in the company is assigned to several groups which are usually called function groups with other parts of the company. With this coordination, a good and harmonious working atmosphere can be achieved,

as well as avoiding chaos in the work. This situation allows the company to maintain quality and improve the quality of the products produced.

c. Money. Companies must provide sufficient money to maintain or improve the quality of their products. For example: for maintenance and repair of production machines or equipment, repair of damaged products, etc.

d. Raw materials. Raw materials are a very important factor and will influence the quality of the products produced by a company. For this reason, controlling the quality of raw materials is very important, companies must pay attention to several things, including: selection of sources of raw materials, as well as storage. This must be done well so that the possibility of low quality raw materials used in the production process can be reduced to as little as possible.

e. Machines and equipment. Machines and equipment used in the production process will affect the quality of the products produced by the company. Incomplete equipment and machines that are outdated and uneconomical will cause low quality of products produced, as well as low levels of efficiency. As a result, production costs become high, while the resulting products will not be marketable. This will result in the company not being able to compete with similar companies that use better machines and equipment.

H. Correlations of Quality

Managers pay attention to quality mainly due to its financial and marketing inferences. It is believed that product advertising, price, profitability, price, and market share are linked to the production of quality.

1. Quality and Price

The theoretical explanation regarding the association between cost and quality takes place in both parts. These two factors are also presumed to have a positive correlation. When quality could be increased at a higher price, and costs and prices have positive relationships as suggested in economic theory, quality and price would progress simultaneously. However, this statement suggests that consumers own adequate information for the evaluation of product quality. Otherwise, they would depend on other cues when evaluation is made, which includes a comparative cost.

According to Riesz, upon the observation of the aforementioned behaviour, their response would be in the form of price readjustment: "Upon the manager's belief that perspectives and customer's purchase decisions have a positive correlation to cost, they could place higher costs to reflect the goods quality. For this reason, cost is a method of distinguishing between products …. These pricing methods … may deteriorate the price-quality association in a goods type". This theory is ambiguous. Furthermore, price and quality may have a positive correlation or vice versa based on the volume of data presented to consumers. The empirical findings are correspondingly mixed. Several research works recorded that the two factors were positively correlated. However, these research works primarily followed experimental proof instead of market data. Upon the use of market data, the findings were distinguished by product category. To be specific, nondurables demonstrated a minor or negative association between quality and price, with the measurement of quality performed by Consumer Report rankings, which commonly emphasise goods condition.

A notable positive association was recorded between the durables. Overall, the results for durables were in line with the study

on the purchase decision for crucial home appliances. Westbrook et al. recorded that 86% of the current buyers and 75% of expected purchasers perceived no challenges in evaluating the quality or dependability of contending brands. Similar research titled, "The Buying Consumer: Room Air Conditioners," recorded that 85% of all purchasers presented the rating of "adequate" or "more than adequate" for the product information presented to them. Upon the availability of this type of information, it is predicted that quality and price are positively related. However, the breakdown of this association occurs in more advanced experimental research works. In this case, multiple cues are available for making inferences on quality in terms of store image, brand name, nation of manufacture, or goods attributes besides cost. The significant cost-quality relation in the previous bivariate study would dampen or be absent. Therefore, quality assessment is hardly based on price compared to other available variables.

2. Quality and Advertising

Initially, the theoretical explanation for a positive correlation between advertising and quality was established by Phillip Nelson. Following that, more formal modelling was obtained by Richard Schmalensee. Nelson first distinguished between "experience" and "search" products. The former features could be identified before purchase, while the latter features could only be learnt after the purchase and use of the product. The fit and cut of an article of clothing is an example of product features that could be understood through searching, while the dependability and strength of a crucial home appliance are among the features that could be understood solely through experience. This is followed by Nelson's statement that for experience products, more significant degrees of advertising would be related to products of higher quality. A summary of this argument was presented by Schmalensee:

Premium brands would gain a higher amount of repeat purchases, ceteris paribus, compared to non-premium brands. Therefore, the sellers of premium brands would use higher expenditure as a way of persuading customers to use wares, considering that ceteris paribus, higher value is currently involved in a trial purchase. Nelson argued that this situation has increased the advertisement for better brands as long as the consumers show response to the advertisements. Thus, the degree of advertising for experience goods has a positive correlation with quality regardless of the claims made in individual ads.

Quality information is presented through the degree of advertising instead of the claims being made. However, the proof of this statement is indefinite. With the use of American and British data, the analyst discovered that product quality and advertising were positively related, with another measurement of quality being conducted by Consumer Reports or Consumers' Bulletin rankings. However, these findings were undermined by other research works. Following Rotfeld and Rozell's review of the study on this matter, it was gathered that "advertised products appear to be of higher quality compared to non-advertised products upon the rating by specific standards in several years …. although no generalisations have been created".

Gilligan and Holmes, who made an expansion on previous research work through the application of diverse measures of brand quality and advertising expenditures, made an identical conclusion, "a product that receives strong advertisement has the possibility to be of low quality as other products". Although these research works included search and experience products, similar conclusions were made if the analysis was restricted to products in the latter type. According to Nelson, considering that strong advertising indicates high quality, it does not receive support from the present proof. Besides, a current survey of consumer viewpoints demonstrates

that most of the respondents perceive that goods that have received advertising have no possibility to be reliable compared to non-advertised products.

3. Quality and Market Share

The association between market share and quality is possibly dependent on the definition of quality. In this case, if a premium product shows significant performance or numerous characteristics, its cost would increase and it would be sold in smaller volumes. However, upon the definition of quality as superior aesthetics, fitness for use, or enhanced adherence, premium prices are not required to be included in high-quality products. In this case, market share and quality have a possible positive correlation.

The entire empirical work on this subject has virtually applied the Profit Impact of Marketing Strategies (PIMS) database. All research works employed the same strongly accumulated quality measure. Each organisation in the PIMS survey was initially presented with several questions: What was the sales percentage for services or products from every business annually, which were higher than the competitors' sales? What was the percentage of low-quality goods? What was the percentage of similar goods? This was followed by the compilation of quality indexes for every organisation through the subtraction of the percentage "inferior" from its percentage "superior."

With these indexes, analysts discovered that market share and quality were positively associated with each other. The businesses in the PIMS research, which showed improvement in quality during the 1970s, raised their market share by five or six times speed compared to those that showed a decrease in quality by three times speed than the relative quality that was fixed.52 With the bivariate and multivariate

approaches, cross-sectional research works have proven the positive relation between market share and quality.

4. Quality and Cost

Theoretical discourses of the association between cost and quality are under three unique types. Based on the product-based approach, one group highlights that direct cost and quality have a positive correlation. The indirect presumption for this argument is that the distinctions in quality indicate the diversity in characteristics, performance, strength, or other product features that need higher-priced elements or materials, supplementary labour hours in construction, or other dedications of tangible resources. This viewpoint is dominated by the American perspective on the subject. A second perspective, which elaborates on the literature work on operations management, perceives that cost and quality have an inverse relation. To illustrate this point, the costs of higher quality are considered lower compared to the obtained savings in warranty, scrap, and rework costs. Following this viewpoint, which is widespread among Japanese manufacturers and elaborates the majority of their commitment to the objective of "constant enhancement," quality equals the unavailability of deficiency, while the prices in this context denote quality prices.55

Quality prices are described as any expenses for a large part of manufacturing or service, which would have taken place upon the first development of the product.56 In the most thorough form, these costs would involve invisible factors as the expenditures for possessing excessive raw materials and work-in-process inventory to ensure that flawed items do not halt the creation and the cost of possessing and conducting excess capacity as compensation for machine clogging and downtime. In reality, measures with less inclusivity are commonly used. The overall quality commonly involves expenditures under

four types, namely appraisal (e.g., product examination), avoidance (e.g., worker training, quality planning, and supplier education), internal collapses (e.g., rework and scrap), and external collapses (e.g., warranty and goods liability).

Several analysts made an extension to this argument through the claim that enhanced adherence would reduce manufacturing costs in the long term. The explanation for this statement has been the predicted relation between quality enhancement and productivity gains. To illustrate, simple designs that could be easily assembled should involve a lower number of employees when the deficiency is reduced. Investments in equipment and machinery increase the consistency of production and improve employees' productivity. Quality enhancements are also predicted to increase savings in the form of scale economies based on experience through their effect on market share and (cumulative) production degrees.

Despite the limitation in the proof, the majority of empirical work indicates that stronger adherence and overall quality costs have an inverse relation. To illustrate, Garvin's research of the room air conditioning industry recorded that Japanese manufacturers showed deficiency and field collapse rates that were lower than U.S. competitors by 15 and 70 times, including overall quality costs that were equal to 1.3% of sales. The average scrap, rework, and warranty costs for the most superior American organisations amounted to 2.8% of sales. In the U.S. organisations with the lowest quality, the prices were higher than 5.8% of sales. Moreover, Garvin recorded that productivity and quality had positive relation although the organisations applied similar technologies and exhibited minor distinctions in capital intensity. In this industry, the U.S. organisations with the most superior quality showed a production level of five times higher upon the measurement by the units, which generated

per man-hour of assembly-line direct labour as organisations with the lowest quality.

Some surveys gathered more thorough data on quality prices, which offers further support for the aforementioned associations. For example, a 1977 survey recorded that organisations with formal systems for the assessment of quality prices, which the majority of analysts linked to high-quality management and minor failure rates that showed lower overall quality costs compared to companies without these systems. The averaged quality costs for the organisations from the former group amounted to 5.8% of sales, while the costs for the organisations from the latter group, rework, scrap, and warranty amounted to 7.8% of sales.

The expenditure of organisations to prevent quality issues and ensure lower failure rates could be highly suboptimal. Gilmore recorded that a minimum of one-quarter of the organisations under survey showed an expenditure of lower than 5% of their quality costs on avoidance, while one-half showed an expenditure of lower than 10%. Therefore, the conclusion he reached was that more significant expenses on prevention would enhance adherence and reduce deficiencies. Overall, these conditions could lead to a decrease in the quality costs due to a large amount of savings in scrap, warranty, and rework.

In general, the use of the PIMS database has been applied to investigate the association between direct cost and quality. Subsequently, the results produced were regarded as diverse by the industry. Based on research work, quality and direct cost had a positive relation with differentiated-product businesses and a negative relation with homogeneous products. In another research, the two showed a positive relation with capital goods businesses and negative relation with supplies and components businesses. However,

the experience curve effect, which comprised a superior quality that increased the market share, led to higher cumulative production. This was followed by a decrease in prices based on experience, which was recorded in all categories of businesses.

The diverse findings from these research works demonstrated the distinctions in the descriptions of quality employed by organisations in various industries. High aggregation took place on the PIMS quality index, although no difference was present between performance, attributes, reliability, or the other previously discussed dimensions of quality. Subsequently, it is possible for various industries to employ various definitions in the assessment of product quality. This condition would decide whether the association between direct cost and quality was positive or vice versa. To illustrate, within homogeneous goods establishments (e.g., chemicals), quality is described as "meeting requirements" in most cases. This adherence-based perspective of quality could lead to a reversed association between quality and direct price. However, within the distinguished and capital goods businesses, quality could be equal to performance or attributes, which suggested a positive link between direct cost and quality. Although these inferences were in line with PIMS results, further studies would be needed for verification.

5. Quality and Advantageousness

Figure 1 presents two methods through which higher quality could increase advantageousness. The first method is through the market, specifically the enhancement in attributes, condition, or other quality dimensions that contribute to higher sales and an increase in market share size or less flexible demand and higher costs. If the cost to achieve these gains is exceeded by the organisation that contributes more, the profits would increase.

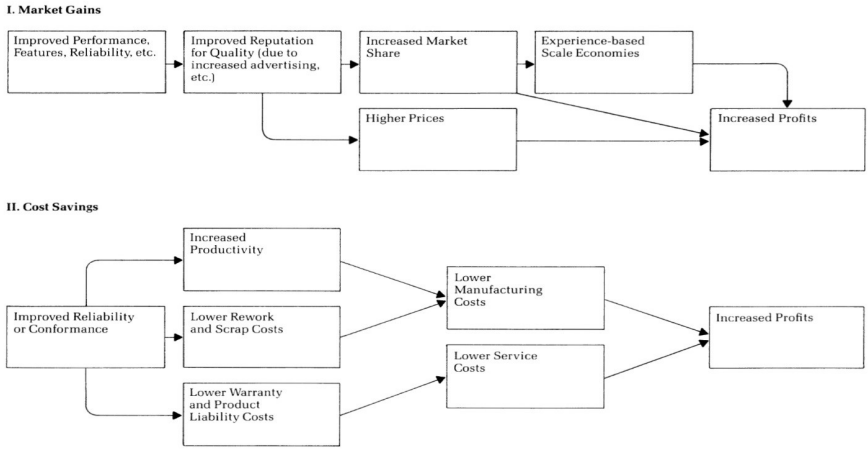


Figure: Quality and Advantageousness

Quality enhancement could also impact advantageousness through price. Lower amount of deficiencies or field failures reduce the service and manufacturing prices when these gains are higher than any rise in spending by the organization on the prevention of deficiency to increase profitability.

Empirical research works through the PIMS database have proven the significant relationship between profitability and quality. Specifically, superior quality contributes to further return on investment (ROI) for any provided market share among establishments with a percentage lower than 12% of the market, such as the businesses with inferior product quality with an average ROI of 4.5%, the businesses with average product quality and ROI of 10.4%, and businesses with high product quality and ROI of 17.4%. Through the increase in share, quality enhancements result in experience-based cost savings and increased gains in advantageousness. Thus, the market-based association between profitability and quality is in line with the proof.

The second association shown in Figure 1 does not have a solid establishment. As presented in an earlier discussion, the association between cost and quality is based on the term definitions. The research works that identified quality with adherence and price with overall quality price recorded a reverse association between the two factors. However, further analysis was not conducted to determine whether advantageousness received the same impact nor did the study focus on the link between quality and the direct price related to the distinctions in capital costs or investment levels, which would impact the association between quality and ROI.

The empirical study on quality showed mixed findings and a small number of clear paths for managers. Determining the association between quality and specific factors including advertising, price, and the direct cost is challenging. A small number of unambiguous findings are present in the literature. Despite the emergence of predicted associations, further studies are important due to the significantly accumulated nature of the quality measures that have been applied. This statement is in line with the research works that relate quality to profitability and market share due to the use of the PIMS database. Overall, these results suggested several paths for upcoming studies.

I. The Significance of Quality

The goal of quality control is to quickly investigate unexpected causes or process shifts such that an investigation into the process and corrective action can be taken before too much product does not conform to the desired product standards. The ultimate goal of quality control is to eliminate variability in the process (Montgomery, trans. Zanzawi, 1990: 120).

Guaranteed quality will certainly influence the export level of the company's products so that orders from buyers will continue to be available in every season. And buyers will continue to collaborate with the company because the level of satisfaction received by consumers is greater as a result of good quality and this can make the company gain profits so that it can survive and compete with similar products in the world garment industry.

According to Russell (1996) quality is considered very important for organizations because:

1. Improving the company's reputation, a company that has produced a quality product or service will receive the title as an organization that prioritizes quality.
2. Reducing costs, by producing quality products, will achieve effective and efficient production activities. Because the products produced are in accordance with customer needs and expectations. Apart from that, by implementing strict quality control, the company will avoid activities that do not produce products or services that are not needed by customers.
3. An increase in market share, an organization's market share will be achieved if cost minimization is achieved, because the organization or company can reduce prices, even though quality remains the main thing.
4. Product responsibility, with increasing competition for the quality of products or services produced, organizations will be required to be increasingly responsible for the design, process and distribution of these products to meet customer needs and expectations.
5. International impact, if an organization can offer quality products or services, then apart from being known in the local market, the

products or services offered will also be known and accepted in the international market.

6. The appearance of the product or service and the perceived quality, quality will make a product known, and this will make the company or organization that produces the product or offers a service also known and trusted by the wider community.

Every management system has a high desire for quality. For example, the application of Total Quality Management (TQM) and Six Sigma in companies always talks about how we can make breakthroughs to improve service quality through improvements, where this quality is important for business.

1. Improve company reputation

By creating quality products, the company will get a good reputation in the eyes of customers. It is even possible that the product will quickly expand to the global market.

2. Opportunity to realize cost reduction

By producing quality products, it means the company is able to carry out production activities effectively and efficiently. The products produced are in accordance with customer needs and expectations so that the number of defective products or defective goods can be reduced to as small as possible (zero waste)

3. Be the key to gaining customer loyalty

Quality is the main key so that the product is known and trusted by the wider community. If you want to increase loyalty to a higher level, make sure you improve quality first. Both product quality and service quality. Currently, consumers tend to choose a product because of its advantages, be it more complete features or better customer service. This can be realized by providing something that

is always different, namely what competitors do not have by making quality the main thing.

The following image presents the significance of goods quality for organizations and customers.

1. For the organization: Goods quality is highly significant for the organization. To illustrate, products of inferior quality would impact the consumer's image and confidence, including the organization sales. Considering that the organization survival could be impacted, it is crucial for every organization to improve quality products.
2. For consumers: Product quality is highly crucial for consumers who have the readiness to cover the high cost due to their expectation for the superior quality of the product. If their satisfaction regarding the product quality is achieved, they would buy from the competitors. Recently, international products of outstanding quality are present in the local market. Therefore, challenges of survival in the market would take place if domestic organizations do not achieve improvement in product quality.

Organizations should place emphasis on product quality prior, throughout, and after development:

1. The organization should create its product based on the consumers' needs. Prior to development, the consumers' needs should be determined by the organization and incorporated into product design requirements.
2. In product development, the organization should employ quality management at all phases of production. Quality control is present in plant and machinery, raw materials, selection and training of manpower, product packaging, and finished products among others.
3. Following the development, the finished product should adhere (match) to the product-design requirements in all factors, particularly quality. The organization should set a superior standard for its product and ensure that the product goes through manufacturing according to the standard. In this case, developing a deficiency-free product is important.

Chapter 5
Quality Tools

A. Seven Basic Quality Tools

Tools are one of the strengths in quality management. Tools help us work more efficiently and effectively, depending on what the tool can help us with. We need information that is more structured and easy to understand from a data collection. For this purpose, tools are needed that can help us process data. In the context of Quality Management, seven quality management tools emerged inspired by Benkei's famous seven weapons. Benkei was a Japanese warrior and monk (sōhei). He is described as a soldier who has high skills in using seven types of weapons and is loyal. Tools that can be used to help realize quality are grouped into two:

The first group is the seven basic quality management tools known as "Seven Basic Tools of Quality". The seven basic tools of quality management are useful tools for mapping the scope of a problem, arranging data in diagrams to make it easier to understand, exploring various possible causes of a problem and clarifying the authentic reality or phenomenon in a problem. The seven tools included in the group of basic quality management tools simplify the analysis process while still referring to the principle of quality management,

namely speaking with facts. The seven basic quality management tools are a collection of mathematical-based statistical tools, but are still easy to teach, so that the seven basic quality management tools can be implemented in non-engineering fields and taught without requiring a high level of education. The tools included in the group of seven basic quality management tools are types of tools that are more quantitatively exploratory in nature, including 1) Check Sheet*/ Check List/ Tally Chart, 2) Strattification Diagram with alternatives 2a) flowchart and 2b) runchart, 3) Histogram, 4) Pareto Diagram, 5) Scatter Diagram, 6) Fishbone Diagram, 7) Control Chart.

The second group is seven new quality management tools which in Sono language are called "Seven New Tools of Quality". Meanwhile, seven new quality management tools, also known as seven management tools, were introduced around the 1970s. Seven new quality management tools were designed in response to the need to solve qualitative problems at the management level. For example, qualitative problems such as differences in viewpoints that lead to excessive debate are solved using affinity diagram tools. The need to group problems or solutions uses a tool called an affinity diagram. The problem of how to determine implementation risks is solved using PDPC. There are also qualitative problems such as how to know if there is parallel work and if there is work that is critical so it cannot be reversed, for this reason arrow diagrams are used. To find out whether a problem stands alone or is related to other problems in a problem that has been tried to be solved but the same problem always appears repeatedly, tools called interrelationship diagrams and matrix diagrams are used.

The initial aim of the seven new quality management tools was in principle to develop quality control techniques using a design approach. Seven new quality management tools were developed

to organize verbal data in a structured manner. In contrast to the seven basic quality management tools used to organize numerical data. However, the use of these seven new quality management tools does not conflict with the seven basic quality management tools, but rather supports each other. The seven new quality management tools are a new set of quality tools and are more qualitatively exploratory in nature. The seven quality management tools included in this group include: 1) Interrelationships Diagram, 2) Affinity Diagram, 3) Tree Diagram, 4) Matrix Diagram, 5) Matrix Data Analysis, 6) Arrow Diagram, 7) PDPC (Process Decision Program Chart).

Quality tools denote the provision of a constant collection of graphical approaches that are known to have the highest functionality in addressing problems associated with quality. These tools are known to be basic due to their suitability for individuals who receive little formal training in statistics and the ability to find a solution to most problems related to quality.

Quality tools are employed by numerous companies for the supervision and management of their quality initiatives. Notably, most companies employ these tools for a wide range of purposes associated with quality control and assurance. Despite the availability of an ample amount of quality tools for specific areas, domains, and applications, several quality tools could be used in these domains. It could be concluded that quality tools could be employed in any situation.

Various tools are employed for various problem-solving purposes and in different manners. Notably, these tools could offer a large amount of information about issues in the company, which subsequently leads to the same resolutions. The price tag is included with these quality tools. A brief training, particularly self-training, would be adequate for an individual's use of the tools. Although some

categories of tools are available for use, there are seven most well-known management tools for quality, which are discussed as follows.

A statistical quality control expert from Japan, Kaoru Ishikawa, believes that statistics can solve 95% of quality problems. Ishikawa suggests increasing the use of statistics by training everyone in the organization to be able to use and master the statistical tools needed for quality control, such as: Pareto charts, fishbone diagrams, histograms, and so on. These statistical tools became known as the 7 Tools which were designed to be simple so they could be used by anyone, including workers with secondary education.

Practitioners and academics who work in the field of quality use names: "The Old Seven", "The First Seven", "The Basic Seven", and many other names to refer to the 7 Tools which consist of: 1. Check Sheet, 2. Scatter Diagram, 3. Fishbone Diagram, 4. Pareto Charts, 5. Flow Charts, 6. Histogram, and 7. Control Charts, because there are 7 Another tool that is often called New 7 Tools. In this post, I only discuss 7 Basic Quality Tools.

There is a seven-step technique known as the "Seven Steps Methodology" for each group, which includes the seven new and the seven basic quality management instruments. The seven-step process consists of:

1. Determine the main problem. So before using quality tools, the first step that needs to be taken is to determine what is actually the core or main problem. This step is the most difficult step. The difficulty lies in how to distinguish between symptoms or indications of a problem and the essence of the problem itself. In many cases, long-standing debates occur regarding differences in views from people who consider symptoms or indications to be a problem. This is understandable considering that symptoms

can be easily seen, while the core of the problem is hidden behind the symptoms. Is an example of declining sales every year a symptom or the core of the problem? If you make a mistake in determining the core of the problem, it is like a doctor making a mistake in diagnosing a disease. The medication given will only treat symptoms and diseases that will never actually be cured.

2. Understand the situation and determine targets/aims/goals. The second step after the core of the problem can be defined is to understand the situation surrounding the problem. Does the problem stand alone or is it related to other things that are developing within the organization or related to changes that are occurring in the organization's external environment, for example social, cultural, economic, political and others? At this stage it is also important to determine what the target or goal of problem solving is. This is important so that the conversation does not spread and does not focus on what should be resolved.
3. Prepare an activity plan. The third step is to plan what activities will be carried out regarding problem solving and achieving problem solving targets/goals.
4. The fourth step is analyzing factors with stages of investigating causes and effects, investigating current and past conditions, conducting stratification experiments, looking at changes over time, and looking at relationships.
5. After carrying out the analysis, then prepare and implement improvement activities/activities that must be carried out as a solution to existing problems related to the target/goal of the desired problem resolution.
6. The sixth step is to ensure effectiveness in the sense of whether improvement activities are carried out correctly and ensure

efficiency in the sense of whether the correct tool or method or approach has been used to solve the problem.

7. Lastly, carry out standardization as far as possible and control patterns by comparing what happens and is produced in the field with standards.

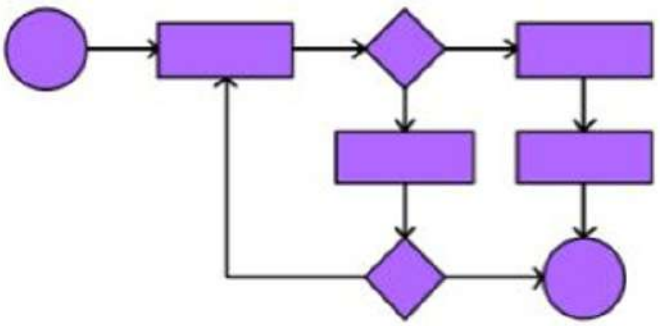
Each stage in the seven-step methodology requires analysis that can be aided by seven basic and new quality management tools. Even though they both have a role as tools in the seven step methodology, the seven basic tools and the seven new quality management tools have a main difference, namely that the seven basic quality management tools are more about quantitative exploration (statistics) while the seven new quality management tools are more about qualitative exploration. The application of the tools mentioned above is not only limited to the scope of QMS (Quality Management System). Because, if only experts who work in other scientific disciplines, such as political experts, economists, marketing experts and so on, are willing to study in depth the use of these tools and understand them well, they can use them to complete their knowledge and skills. analytical skills.

For example, if we are a politician who is facing a split in the members of his organization, or is facing a crisis of trust from his constituents, and if we have mastered the seven basic and new tools of quality management and the seven-step methodology in, then in facing this problem, we will try to collect data using survey methods and using Checksheet tools, then the "raw data" obtained will be analyzed again using other tools, for example with Pareto diagrams, to determine problem priorities, then using Fishbone diagrams to trace the causal factors that are likely to be dominant as the root of the problem, and then create a solution. In this way, even a political problem can be traced, analyzed and conclusions and decisions made through the use of quality control tools.

A statistical quality control expert from Japan, Kaoru Ishikawa, believes that statistics can solve 95% of quality problems. Ishikawa suggests increasing the use of statistics by training everyone in the organization to be able to use and master the statistical tools needed for quality control, such as: Pareto charts, fishbone diagrams, histograms, and so on. These statistical tools became known as the 7 Tools which were designed to be simple so they could be used by anyone, including workers with secondary education.

1. Flow Charts

Flow charts are a tool to visualize the process of completing a task step by step for the purposes of analysis, discussion, communication, and can help us to find areas of improvement in the process. The image below shows an example of a flow chart. To find out the meaning of flowchart symbols and how to use them, please open the post entitled: Standard Flowchart Symbols and Their Use.



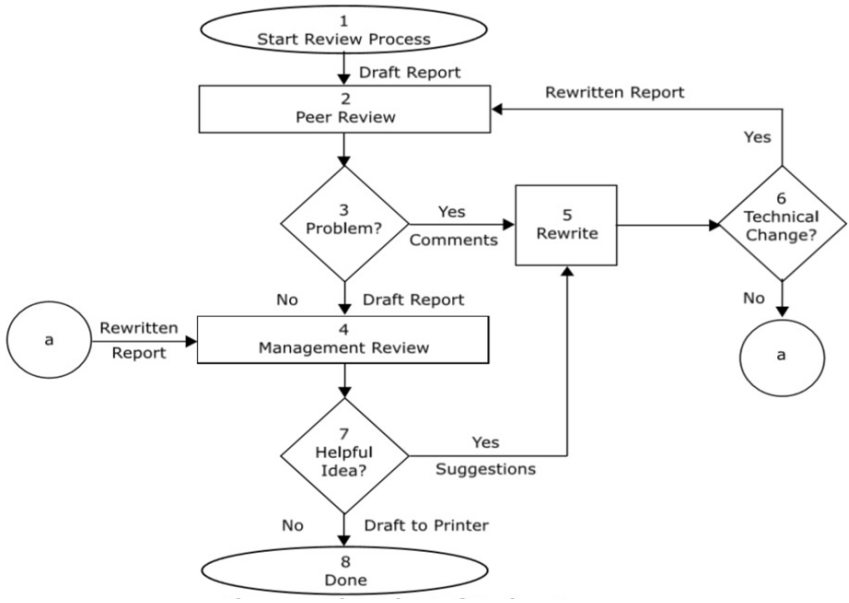
Examples of Flow Charts

Flow charts is among the basic quality tools that could be employed to analyse and illustrate a series of events, which take place in sequence or parallel. The flow chart could be employed to understand a complex procedure to determine the associations and dependence between events. An essential understanding of the

crucial stages in the process could also be obtained through flow charts. Overall, the use of flow charts is applicable in any area for a simple elaboration of complex procedures. Certain software tools are created to draw flow charts, which include MS Visio.

Flowcharts graphically present a process or system using interconnected boxes and lines. This diagram is quite simple, but it is an excellent tool for trying to understand a process or explain the steps of a process. Flowcharts are used as an analytical tool to:

1. Collect data, implement data, and are also a visual summary of the data, making it easier to understand.
2. Shows the output of a process.
3. Shows what is happening in a particular situation over time.
4. Shows trends in data over time.
5. Compare data from one period with another period, also checking for changes that occur.



Flow chart of review process

Also known as a process flow diagram, a flow chart represents an image of every stage involved in a procedure in sequence. It is a generic tool where adaptation for various purposes and use for describing diverse procedures are possible, which include manufacturing procedures, administrative or service procedures, or a project plan. Furthermore, it is a typical process analysis instrument and among the seven essential quality instruments. The components that could be incorporated in a flowchart include a series of materials, actions, or services that enter or leave the procedure (inputs and outputs), decision making, involved individuals, the duration for each stage, and/or measurement of the process.

Flow chart is used for the following purposes:

- ✓ To understand the steps in a procedure
- ✓ To investigate a procedure for enhancement
- ✓ To hold communication regarding the flow of a procedure
- ✓ When communication improvement is required between individuals who are engaged in the same procedure
- ✓ For the documentation of a procedure
- ✓ When planning a project

FLOWCHART BASIC PROCESS

- ✓ Describe the procedure to be represented, followed by writing the title above the work surface.
- ✓ Make a decision regarding the bounds in the image: Where or when does the procedure begin? Where or when is it concluded? Make a discussion and decision on the degree of detail to be added to the image.

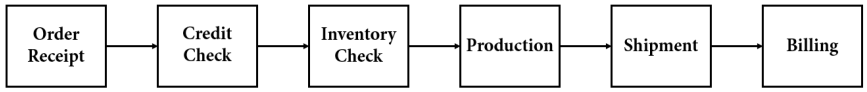
- ✓ Conduct a brainstorming on the events that occur, which is to be written on a card or sticky note.
- ✓ Organise the events in the correct order.
- ✓ Upon the incorporation of all events and all individuals perceive the order to be correct, demonstrate the procedure by drawing arrows.
- ✓ Evaluate the flowchart with other parties in the procedure (supervisors, workers, customers, and suppliers) to determine if it is agreed that the procedure has an accurate drawing.

FLOWCHART CONSIDERATIONS

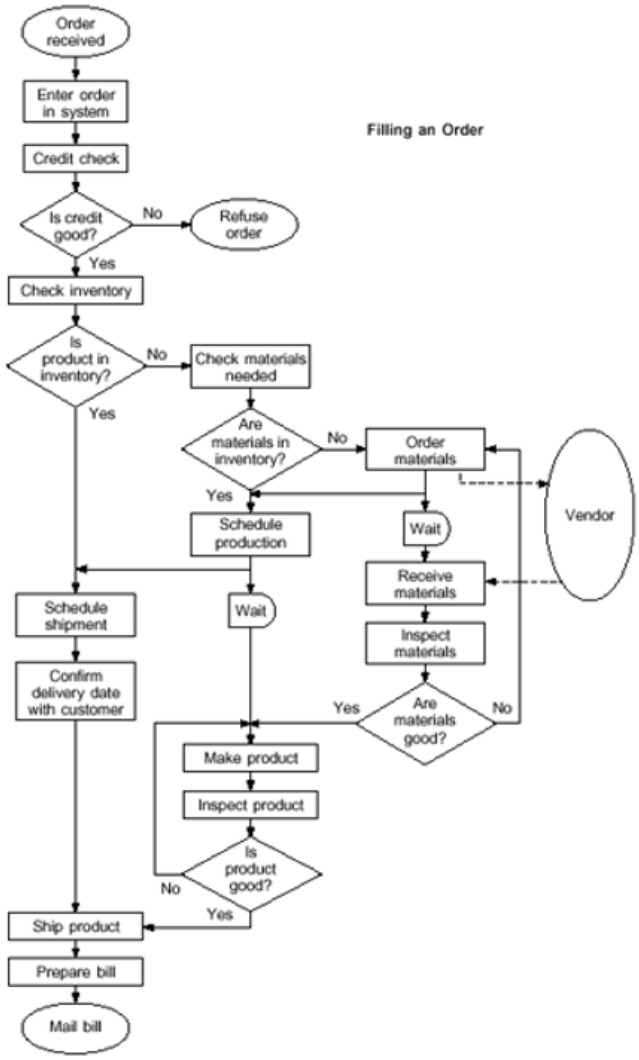
- ✓ Do not be concerned about the "correct methods" of drawing the flowchart. Eventually, the correct method assists the individuals in understanding the process.
- ✓ Have all the necessary individuals involved in the flowcharting procedure, which comprises the customers, suppliers, and supervisors. Have them engaged in the real flowcharting sessions through an interview prior to the sessions and/or demonstration of the building flowchart between work sessions and feedback recording.
- ✓ Employ a "technical expert" to design the flowchart, which should be conducted by individuals who conduct the procedure.

FLOWCHART EXAMPLES

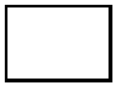
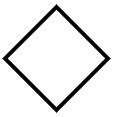
1. High-Level Flowchart for an Order-Filling Procedure



2. Detailed Flowchart



OFTEN EMPLOYED SYMBOLS IN COMPLETE FLOWCHARTS

	A single stage in the procedure. The stages are within the box. Normally, only one arrow flows outside the box.
	Management of flow from one stage or decision to another.
	Decision in line with the question, which is presented in the diamond. Two or more arrows leave the diamond, with each demonstrating the procedure direction for an answer provided to the question (the answers are "yes" and "no" most of the time).
	Set back or stand by
	Connect to another flowchart or page. The identical symbol on the other page implies that the flow proceeds from that point.
	Input or output
	Document
	Alternative symbols for the beginning and ending points

2. Histogram

A histogram is a tool that helps to determine variations in a process. In the form of a bar chart that shows a tabulation of data arranged based on size. This tabulation of data is generally known as a frequency distribution. Histograms show the characteristics of data

divided into classes. Histograms can be "normal" or bell-shaped, indicating that much of the data is at the average value.

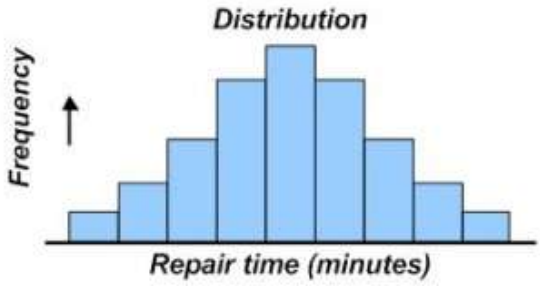
A slanted or asymmetric histogram shape indicates that a lot of data is not at the average value but most of the data is at the upper or lower limit. The benefits of a histogram are:

1. Provides an overview of the population.
2. Shows variables in the data arrangement.
3. Develop logical groupings.
4. Variation patterns reveal product facts about the process.

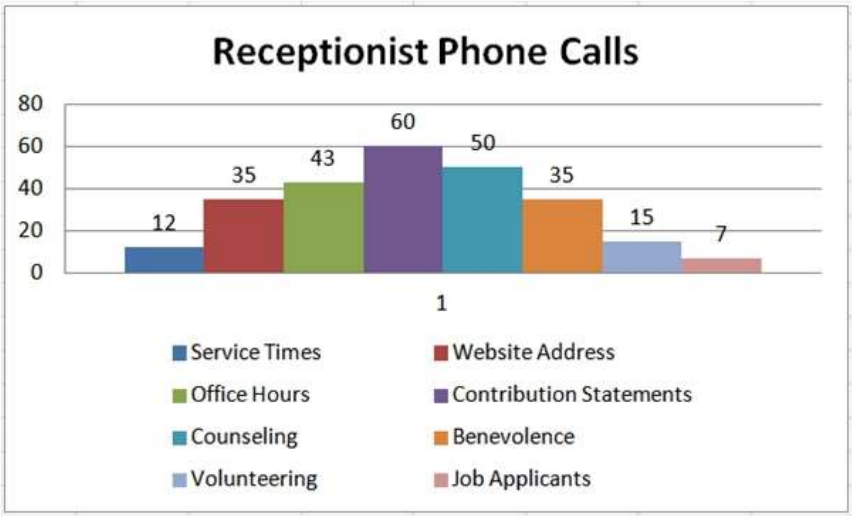
A histogram is a graphic display to visually show the distribution of data or how often different values occur in a data set. The benefit of using a Histogram is to provide information about variations in the process and assist management in making decisions in an effort to continuously improve the process (Continuous Process Improvement).

Histogram is a bar graph-like tool used to show frequency distribution. A frequency distribution shows how often each different value in a data set occurs. The data in the histogram is divided into classes, the observed values from each class are shown on the X axis.

Theory says that a normal distribution, that is, where most of the data is close to the average value, will be shown by a bell-shaped histogram, as in the example image below. But if the histogram is skewed to the left or right, it means that most of the data gathers near the tolerance limit of a measurement, so there is a possibility that the data is not normal (there was a problem during the measurement, or even a problem in the process). To ensure whether the data is normal or not, it is best to use a data normality test method, such as the Kolmogorov-Smirnov test or the Anderson-Darling normality test.



The use of histogram is for presenting the occurrence and range in the context of two variables. Furthermore, the histogram is a chart comprising columns, which indicates its administration by mean. With a normal histogram, the graph appears in the form of a bell curve, while the non-normal histogram could appear in various forms based on the state of the distribution. A histogram could be employed for measuring a subject against another subject in the context of two variables. This condition demonstrates that the receptionist receives the highest number of phone calls regarding contribution statements at this point.



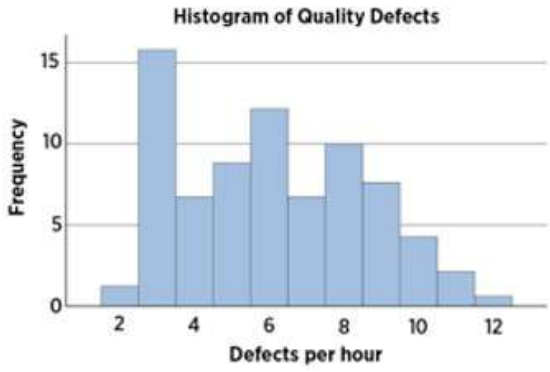
A frequency distribution demonstrates the frequency of the emergence of every distinct value in specifics. Notably, the histogram

is the graph with the highest use frequency to demonstrate frequency distributions. Although it strongly resembles a bar chart, notable distinctions are present. This useful analysis and data collection tool are regarded as one of the seven essential quality components.

WHEN TO USE A HISTOGRAM

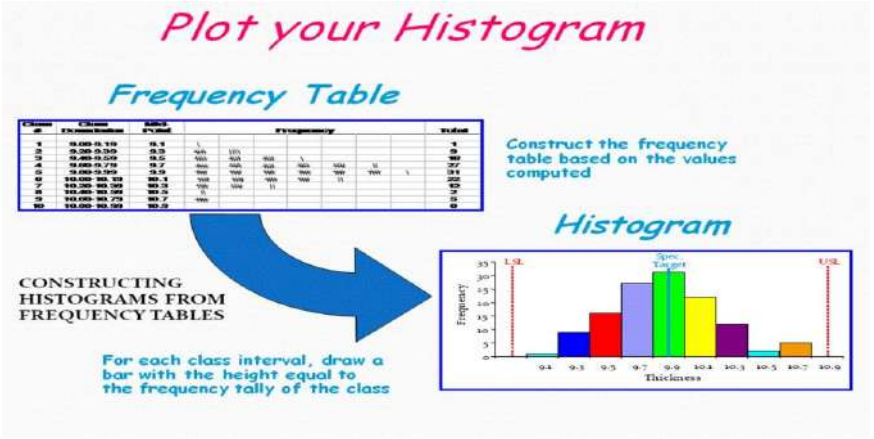
A histogram is used during the following situations:

- The data are numerical.
- One attempts to form the data administration, particularly when it is determined whether the output of a procedure has a normal approximate distribution.
- An analysis is conducted on whether a procedure fulfils the customer's specifications.
- An analysis is performed on the appearance of the output from a supplier's procedure.
- When a procedure change is determined to occur from one time to another.
- The difference between the outputs of two or more processes is determined.
- Communication is attempted in the administration of data at a fast rate and with convenience.



HOW TO DEVELOP A HISTOGRAM

- ✓ Gather a minimum of 50 successive data points from a procedure.
- ✓ Employ the histogram worksheet to establish the histogram to decide on the number of bars, the scope of numbers that flow into every bar, and the identification of the bar edges. Following the calculation of W in Step 2 of the worksheet, make an adjustment to the convenient number based on your perception. To illustrate, you may attempt to round off 0.9 to an even 1.0. Additionally, the value for W should not have higher decimal places compared to the quantities to be graphed.
- ✓ The x- and y-axes are to be drawn on graph paper. The labelling is made on the y-axis to count the data values, while the x-axis is labelled with L values from the worksheet. The distances between these numbers would be the histogram bars without making distances between the bars.
- ✓ For every point of data, check one count on the upper of the suitable bar with an X or drawing shades on that part of the bar.



HISTOGRAM WORKSHEET EXAMPLE

Process: _____ Calculated by: _____

Data dates: _____ Date: _____

Step 1. Number of bars

Find how many bars there should be for the amount of data you have. This is a ballpark estimate. At the end, you may have one more or less.

Number of data points	Number of bars *(B)*
50	7 8 9
100	10 11
150	12 13
200	14

B = _____

Step 2. Width of bars

Total range of the data = *R* = largest value – smallest value

= _____ – _____ = _____

Width of each bar = *W* = *R* ÷ *B*

= _____ ÷ _____ = _____

Adjust for convenience. *W* must not have more decimal places than the data.

W = _____

Step 3. Find the edges of the bars

Choose a convenient number, *L*1, to be the lower edge of the first bar. This number can be lower than any of the data values. The lower edge of the second bar will be *W* more than *L*1. Keep adding W to find the lower edge of each bar.

*L*1	*L*2	*L*3	*L*4	*L*5	*L*6	*L*7	*L*8	*L*9	*L*10	*L*11	*L*12	*L*13	*L*14
—	—	—	—	—	—	—	—	—	—	—	—	—	—

Histogram Analysis

The area of the histogram is appropriate to the limits of requirements and the histogram form is able to indicate a large amount of the procedure under analysis. The data based on the "normal distribution" creates a matter known as a curve in the shape of a bell, which is a common shape observed upon plotting a histogram of variable data. However, diverse shapes are visible, which is a multi-modal administration with two peaks or more.

A bimodal distribution comprises two peaks on the graph, which implies the change of a subject upon data collection, such as the change in settings between two shifts or raw materials in production. Skewed distributions take place when the data is bundled up to one area with a long tail. This condition could take place when a material is cut, which prevents longer cuts and enables shorter cuts.

When the form of the histogram distribution is compared to the requirement limits, it could indicate whether the procedure is able to meet the requirements. If the tails are in the upper and lower requirement limits, restrictions would take place. The top of the bar chart could also indicate if the nominal specification is achieved, which enables important adjustments to be made. For a convenient quality tool, the histogram or bar chart is extremely useful to identify a large amount of data about the potential of these processes and create constant enhancements.

COMMON HISTOGRAM FORMS AND THEIR MEANINGS

Normal Distribution

A typical pattern is a curve in a bell shape identified as "normal distribution". In a common or "typical" distribution, there is less possibility for points to take place on one part of the average as on the other. It is important to know that the distributions are identical to the normal distribution. Statistical calculations should be employed to demonstrate a normal distribution. Furthermore, "normal" should denote the common distribution for a certain procedure. To illustrate, numerous procedures show a natural restriction on one part and would create skewed distributions. This condition is common even when the distribution is not regarded as "normal".

Normal distribution

Skewed Distribution

The skewed distribution is not symmetrical, considering that a natural restriction avoids the results on one part. The highest point of the distribution is off-centre towards the limitation, while a tail is stretched away from it. To illustrate, the distribution of analyses of goods with high purity will be distorted, considering that the product should not exceed 100% of purity. Other instances of natural limits include the holes which size should not be less than the diameter of the drill bit or call-handling periods that should not amount to lower than zero. Overall, these distributions are known as right- or left-skewed based on the tail movement.

Right-skewed distribution

Double-Peaked or Bimodal

The bimodal distribution appears in the form of a two-humped camel's back. The combination of the results of two procedures with distinct distributions is made with a single data set. For instance,

production data distribution from a two-shift function may be bimodal upon the production of distinct outcome distribution through every shift. This issue is frequently visible through stratification.

Bimodal (double-peaked) distribution

Plateau or Multimodal Distribution

The plateau may be identified as "multimodal distribution". A combination of some procedures with normal distributions takes place. Due to the numerous peaks near one another, the top of the distribution is identical to a plateau.

Plateau distribution

Edge Peak Distribution

The edge peak distribution is identical to the normal distribution with the exception that it presents a significant highest point at a single tail. This condition is commonly attributed to defective histogram design while the data is gathered into a category with the label "more significant than".

Edge peak distribution

Comb Distribution

In a comb distribution, the bars are alternatively high and low. In most cases, this distribution is caused by the rounded-off data and/or a falsely formed histogram. For instance, temperature data is levelled off to the closest 0.2 degrees, which will appear in a comb shape with a bar width for the histogram of 0.1 degrees.

Comb distribution

Truncated or Heart-Cut Distribution

The truncated distribution appears as a normal distribution that includes the cut-off of the tails. It is possible for the supplier to present a regular distribution of matter and rely on examination to specify the matter in the requirement limitations and outside the requirements. The achieved shipments to the consumer from within the requirements are the heart-cut distributions.

Truncated or heart-cut distribution

Dog Food Distribution

There is an element that is not present in the dog food distribution, which is the outcome close to average. When this type of distribution is received by the customer, another individual would receive a heart cut and the "dog food," while the fragments would remain following the master's meal. Although what is accepted by the consumer is in the requirements, the goods would be under two groups: one group close to the upper requirement limitation, while one group close to the lower requirement limitation. In most cases, this variation leads to issues in the customer's procedures.

Dog food distribution

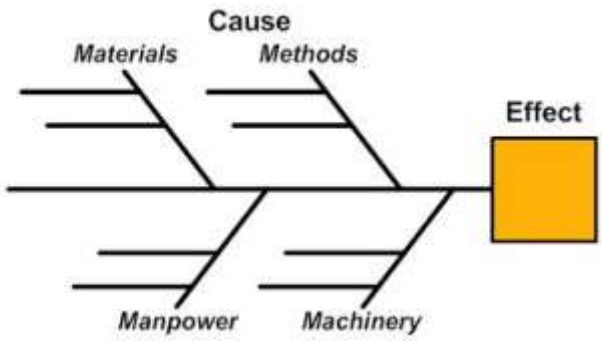
3. Cause and Effect Diagram

Cause and Effect Diagram is a QC tool that is used to identify and show the relationship between cause and effect in order to find the root cause of a problem. Cause and Effect Diagrams are used to show the causal factors and quality effects caused by these causal factors. Because of their shape like fish bones, Cause and Effect Diagrams are also called Fishbone Diagrams.

Fishbone diagrams are often called Ishikawa diagrams or cause-and-effect diagrams. Fishbone diagrams are a tool for identifying various potential causes of a single effect or problem, and analyzing the problem through a brainstorming session. Problems will be broken down into a number of related categories, including people, materials, machines, procedures, policies, and so on. Each category has reasons that need to be explained through a brainstorming session.

The image below shows an example of a fishbone diagram with manpower, machinery, materials, and methods as categories. This

category is just an example, you can use other categories that can help organize ideas. There should be no more than 6 categories.



Fishbone Diagram or Cause and Effect Diagram is one of the QC 7 tools which is used to identify and show the relationship between cause and effect in order to find the root cause of a problem. Fishbone Diagrams are used to show the causal factors and quality effects caused by these causal factors.

This Fishbone Diagram is also known as a Cause and Effect Diagram. It is said to be a Fishbone Diagram because its shape resembles a fishbone skeleton. There are also those who call this Cause and Effect Diagram the Ishikawa Diagram because the first person to introduce this Cause and Effect Chart was Prof. Kaoru Ishikawa from the University of Tokyo in 1953.

This Fishbone Diagram or Cause and Effect Diagram is used to:

1. Identify the root cause of a problem
2. Get ideas that can provide solutions to solving a problem
3. Help in finding and investigating further facts.

Steps required to create a Cause and Effect Diagram:

1. Provide a title, date, product name, process name and list of participants' names
2. Determine the problem statement to be resolved
3. Draw a fish head as a place to write the effect
4. Write the statement of the problem in the fish's head as a result (effect) of the causes.
5. Describe the fish spine and the large bones of the fish.
6. Write down the main causal factors that influence the quality of the large bones of the fish. In general, the main causal factors in production consist of 5M + 1E, namely:
    - Machine
    - Method
    - Man
    - Material or production materials
    - Measurement
    - Environment
7. Write down the secondary causes based on the Main causal factor category and write them in Medium-sized bones
8. Write down the causes in more detail that influence the secondary causes then draw the bones which are even smaller.
9. Determine the causal factors that actually have a real influence on quality, then put a mark on these causal factors.

Mustofa (2014) explains that fishbone charts are useful for showing the main factors that influence quality and have consequences for the

problems we study. Apart from that, we can also see more detailed factors that influence and have consequences on these main factors which we can see from the fishbone-shaped arrows on the fishbone diagram. This cause and effect diagram was first developed in 1950 by a quality expert from Japan, namely Dr. Kaoru Ishikawa who uses graphic descriptions of process elements to analyze potential sources of process deviations. These main causal factors can be grouped into:

1. Material
2. Machine
3. Man
4. Method
5. Environment

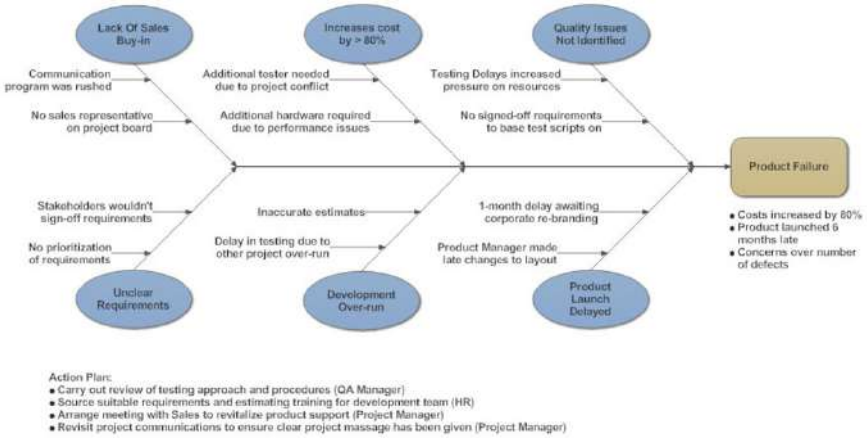
The uses of cause and effect diagrams are:

1. Help identify the root cause of the problem.
2. Analyze actual conditions with the aim of improving quality improvement.
3. Helps generate ideas for solutions to a problem.
4. Assist in further fact finding.
5. Reduce conditions that cause product incompatibility with consumer complaints.
6. Determine the standardization of ongoing or future operations.
7. Means of decision making in determining workforce training.
8. Plan corrective action.

The steps in creating a cause and effect diagram are as follows:

1. Identify the main problem.
2. Place the main problem on the right side of the diagram.
3. Identify minor causes and place them on the main diagram.
4. Identify minor causes and assign them to major causes.
5. The diagram has been completed, then an evaluation is carried out to determine the real cause.

Generally, issues are faced by companies on daily basis, leading to the understanding and finding an effective solution to the factors of the issues. Teamwork commonly takes place in cause and effect diagram exercises. Cause and effect diagrams (Ishikawa Diagram) are employed to understand the factors leading to an organizational or business issue. A brainstorming session is important to determine an effective cause and effect diagram. All the primary elements of an issue are identified, including the probable associated factors to be analysed further.



Cause and Effect Analysis was developed by Professor Kaoru Ishikawa, a developer of quality management in the 1960s. This was followed by the publication of this approach in his 1990 book, "Introduction to Quality Control". The diagrams that could be formed are the Ishikawa Diagrams or Fishbone Diagrams, given that a finished diagram could resemble a fish skeleton. Despite its original development as a quality control tool, other uses of this approach are also present, such as follows:

- ✓ Determine the factor leading to an issue.
- ✓ Reveal the bottlenecks in the procedures.
- ✓ Determine the place and reason for the dysfunctionality of a procedure.

What is a Cause and Effect Diagram?

A cause and effect diagram investigates the factor leading to a phenomenon through the specification of the possible factors under a more specific classification. It could also be used to demonstrate the association between the determinants.

One of the Seven Basic Tools of Quality is described as a fishbone diagram or Ishikawa diagram in most cases. Similarly, the cause and effect diagrams are also identified as fishbone diagrams as the finalised diagram appears similar to a fish skeleton, in which the fish head is on the diagram's right, while the bones are separated from its behind to the left.

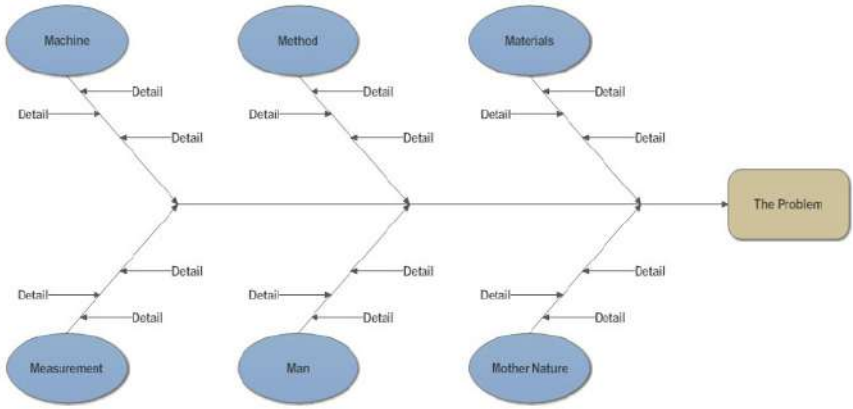
Cause and Effect Analysis

To create a cause and effect diagram, the primary concern is involved in the analysis in the box on the right side of the page and midway to the bottom of the drawing space. A line known as the

"spine" or "backbone" must be extended to the left that begins from the side of the primary box (if a SmartDraw template is used, it would be readily available). Following that, the angle is separated from the spine, each denoting the cause or effect of the primary concern. Every separated section would comprise further sections.

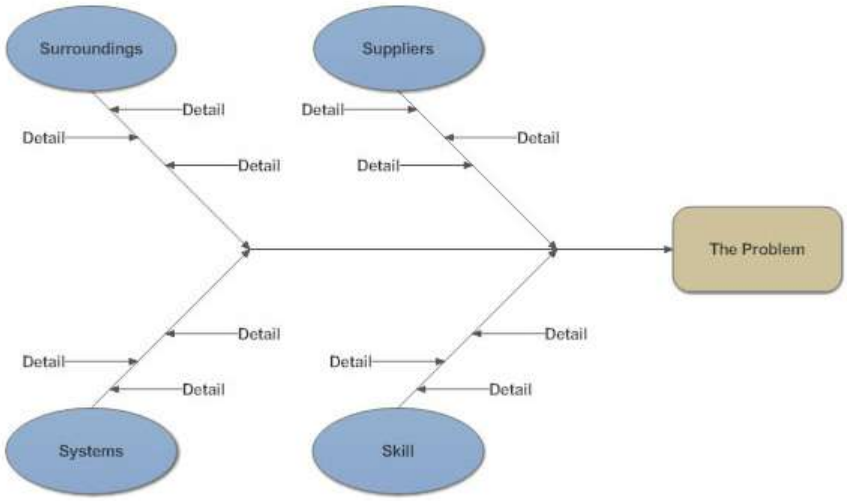
Notably, the majority of the cause and effect diagrams investigate the same group of probable factors for any concern under analysis. In the manufacturing industry, these factors are identified as 6Ms:

- **Approaches**. Are the training instructions properly outlined? Are specific rules leading to disruptions or unneeded procedures?
- Machines. Are any maintenance problems present in the employed tools or the quantity of tools?
- **Materials**. Are any concerns present in obtaining raw materials from suppliers, transportation (timing), or condition of the supplies?
- **Measurements**. Are there any possible flaws in contamination or calculation that lead to false readings? Is there any possibility that the measurement is not consistent? Does your equipment receive regular calibration and maintenance?
- **Mother Nature/Environment**. Is there excessive humidity in the environment? Is there excessiveness in the heat or coolness, dust, or other contamination?
- **Manpower/People**. Is your workforce for a procedure inadequate? Have the new individuals received enough training? Does the training have consistency? Do the correct individuals with the correct experience receive their employment and promotion? Is there any role that causes a bottleneck or high occurrence of mistakes?



In a manufacturing analysis, two other classifications are included, namely management and maintenance. These are known as the 4S in the service industry:

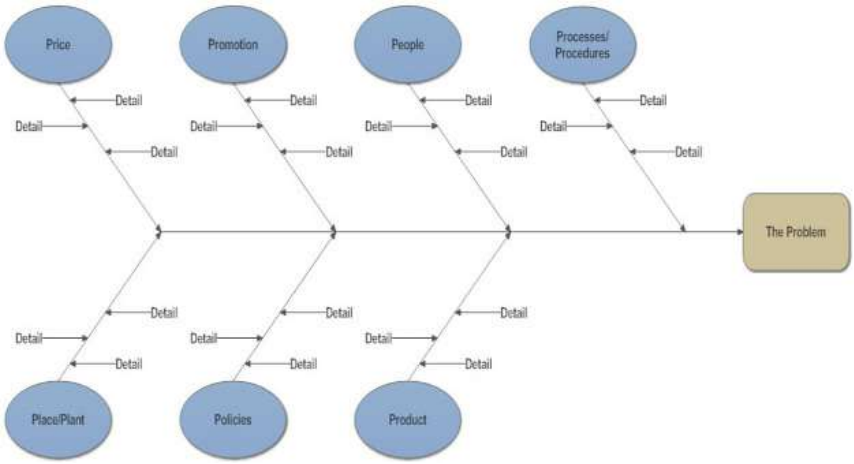
- **Surroundings**. Does your business present the correct? Is it run-down? Is it unbiased? Does it provide comfort?
- **Distributors**. Are there any concerns in your service delivery? Are you faced with the poor distribution of food? Is there an excessive amount of missed phone calls? Is your server able to manage traffic spikes? Do you receive adequate traffic through the advertisement of channels that you invest in?
- **Systems**. Do you employ the strategies and processes in all contexts? Do you employ modern cash registers that assist the servers in placing orders and delivering checks with efficiency?
- **Expertise**. Do your workers receive proper training and the correct experience?



A fifth classification known as "safety" will be incorporated. In the marketing industry, cause and effect diagrams mostly comprise the following 7Ps:

- **Goods**. All factors of your product should be taken into account, which include its standard, availability, perceived image, warranties, customer service, and support.
- **People**. Interaction with various individuals may occur upon the purchase of product or service, which include delivery people, sales people, and customer service people among others. Are there any possible issues with your organization culture?
- **Procedure**. How the issues in your organization are managed? Do they increase appropriately? Do your staff receive and follow appropriate training?
- **Exposure**. Sales, PR, direct marketing, advertising, branding, social media, and partnerships are taken into account.

- **Price**. What is the cost of your goods or service in comparison to the competitors? What are the present discounts and ways of payment?
- **Physical evidence/Packaging**. What is the consumption method of your product or service? Is the way and place where you show your product harming your capability for conversion? Do you have clean facilities? Is the cost of the packaging low or high?
- **Place/Plant**. Do you apply systematic and cost-effective distribution? Is the selling of your product performed at the correct establishments or neighbourhoods? Do your establishments offer convenience to your target customers?



Ideal Operations in Cause and Effect Analysis

Following are the ideal and most well-known actions in making the cause and effect diagrams.

- **Determine the issue**. Identify the procedure or concern to be investigated.

- **Brainstorming**. Make a discussion of all the probable factors and classify them.
- **Create the backbone**. After identifying the issue, a straight and horizontal line known as the spine or backbone is drawn on the page, while a rectangle is drawn on the right side of the page. Make a short elaboration of the issue in the rectangle.
- **Include causes and effects**. Causes are included with the lines separating from the primary backbone at an angle. Elaborate on the cause at the branch end. One of the primary classifications is normally discussed. The information regarding the cause or effect could be included as sub-classes that are separated from the primary branch. Make further separation and a cause or effect until the documentation of all elements is made. The outcome must be identical to a fish skeleton.
- **Analysis**. Upon the completion of the diagram, analysis of the information in a sequence to achieve a resolution and develop action items.

4. Check Sheet

Check Sheet or what people often call Check List or Tally Chart, is the first of seven basic quality management tools that is simple and used to record and classify data that has been observed. A check sheet is a list that contains or includes the factors you want to investigate. A check sheet is a list containing elements that may be present in the situation or behavior or activity of the individual being observed.

From the definition of Check Sheet above, it can be concluded that Check Sheet is a method for obtaining data in the form of a list containing statements and questions that you want to investigate by placing a check mark. This tool is an easy and simple data recording

sheet, thereby avoiding errors that might occur in collecting the data. Generally, the Check Sheet contains questions that are designed in such a way that the note taker only needs to mark the available columns and provide information as necessary.

As one of the seven basic quality management tools, which in Sono language terms are seven basic quality tools, the check sheet has a function as a tool for recording observation results from inspections of production process distribution, items, locations and causes of defective or damaged products, as well as a confirmation tool. inspection. So what are the benefits of using check sheets in the context of quality management? The benefits that can be obtained from using check sheets in managing quality are mainly for:

1. Makes the process of collecting data easier, especially to find out how problems often occur. This convenience will have an impact on efficiency in data collection.
2. Makes it easier to sort data into different categories such as causes, problems and so on. Data that has been sorted in detail is collected using check sheets, while also facilitating further processing to provide an overview of the factors that are relevant to the problem being faced.
3. Makes it easy to organize data automatically, so that the data can be used easily.
4. Makes it easier to separate opinions and facts.

The convenience obtained from using checksheets will have an impact on saving time and costs in terms of data collection. Furthermore, data that can be collected quickly, sorted and validly means the data can be analyzed in detail for the purposes of making accurate decisions in terms of quality control. The size of

the benefits that can be obtained from using check sheets depends on many things. Apart from depending on the human factor who is the observer filling in the check sheet, it also depends on whether the check sheet used is good or bad. The better the check sheet, the greater the benefits that can be obtained if the observer notes are also good. Then what is a good check sheet? What kind of check sheet? A good check sheet has at least six characteristics, namely:

1) In accordance with the objectives that have been formulated in advance,
2) Planned systematically,
3) In a practical and good format,
4) Check results are processed according to the objectives,
5) Can be checked for validity, reliability and accuracy,
6) Quantitative in nature. Apart from the six characteristics above, a good check sheet must have a structure that contains information on the title of the check sheet, identity of the filler, instructions containing an explanation and purpose of the check sheet, instructions for filling it in and check sheet items or items.

The characteristics and structure of the check sheet are the minimum characteristics and structure to be considered a good check sheet, regardless of whether the check sheet is individual or group, the check sheet is in the form of an assessment scale or questionnaire, or even a problem check sheet.

Once we know the characteristics and structure of a good check sheet, the question is how to create and implement it. The following is how to create and implement a good check sheet:

Step 1.The first step in creating a check sheet is to clarify the measurement target. To help clarify measurement goals, we can answer questions such as what is the problem? Why should data be collected? Who will use the information collected and what information do they actually want? Who collects the data?

Step 2. The second step is to identify what will be measured and when to measure, for example Title: Customer complaints, Category: Late delivery, rude driver, inappropriate billing, etc.

Step 3. The next step is to determine the time or place to be measured. This is intended to be able to identify when and where data was obtained.

Step 4. This fourth step is the data collection implementation step. Data is collected by recording each event directly on a check sheet. What needs to be paid attention to is not to delay recording information until the end of the day or until you rest, in case you forget it.

Step 5. The final step is to add up the data or recapitulate the data. That is, adding up all events (for example, how many late shipments this week, how many incorrect billings, etc.)

To provide an overview so that you can better imagine what it is like to create and implement a check sheet, below we present several examples of check sheets for various different purposes in managing quality and have been filled in.

Check Sheets are tools that are often used in the Manufacturing Industry to collect data in the production process which is then processed into information and results that are useful in decision making.

A check sheet is a simply designed sheet containing a list of things needed for data recording purposes so that users can collect

data easily, systematically and regularly when the data appears at the scene. Data in check sheets, whether in the form of quantitative or qualitative data, can be analyzed quickly (directly) or used as data input for other quality tools, for example to input Pareto chart data.

The image below shows an example of a check sheet used to collect hourly defect data.

	Hour								
Defect	1	2	3	4	5	6	7	8	**Total**
A	II	𝍸 III	𝍸	IIII	II	II			23
B	III	IIII	II	IIII	I	I	III	I	19
C	II	I	III	𝍸 II	II	IIII	II	III	24
D						II			2
E	I	II					II	IIII	9
Total	8	15	10	15	5	9	7	8	77

A check sheet could be described as the most essential component for quality. It is generally employed for the collection and organisation of data. When this action is made with the assistance of software packages including Microsoft Excel, more analysis graphs and automation could be obtained through the existing macros. Thus, the use of a software check sheet would be ideal for collecting information and managing the needs. Additionally, a paper-based check sheet could be used when the information collected is applied for backup or storing purposes besides more processing.

According to Yuwono (2013), a check sheet or inspection sheet is a tool for collecting and analyzing data which is presented in tabular form containing data on the number of goods produced and the types of nonconformities along with the quantities produced. The purpose of using this check sheet is to simplify the process of data

collection and analysis, as well as to identify problem areas based on the frequency of type or cause and make decisions about whether to make improvements or not. This is carried out by recording the frequency of appearance of a product's characteristics relating to its quality. This data is used as a basis for conducting quality problem analysis. The benefits of using a check sheet are as a tool to:

1. Make it easier to collect data, especially to find out how a problem occurred.
2. Collect data about the type of problem that is occurring.
3. Automatically organize data so it is easier to collect.
4. Separate opinion from fact.

Motor Assembly Check Sheet

Name of Data Recorder: Lester B. Rapp
Location: Rochester, New York
Date Collection Dates: 1/17 - 1/23

Defect Types/ Event Occurrence	Dates							TOTAL
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Supplied parts rusted		8	5	4	2			20
Misaligned weld			3			2		5
Improper test procedure								0
Wrong part issued		1		2				3
Film on parts								0
Voids in casting				4	2			6
Incorrect dimensions						2		2
Adhesive failure								0
Masking insufficient					1			1
Spray failure			5					5
TOTAL		10	13	10	5	4		

The check sheet is an addition of a straightforward and functional component used in Lean Six Sigma projects. In some cases, it is known as a location plot or concentration diagram. It is an efficient component for collecting and analysing data via both

quantitative and qualitative methods. The check sheets also assist in systematically collecting and organising data and are effective in all phases of the Lean Six Sigma DMAIC (description, measurement, analysis, enhancement, and regulation) framework.

Being the most straightforward quality tool, it essentially attempts for the standardisation and organisation of data collection, which could be through worksheets or tables. With this sheet, the person in charge travels to Gemba to gain an understanding of the procedures of the activities to determine the origin of the problem and make data collection to determine the factor of the issue.

In the case of the term "Gemba", it is a Japanese word that means the "real place" in which the entire process occurs. This term is identical to Genchi Genbutsu words "go see", which means to travel to the site where the issue occurs, make data collection, and aim to solve the issue. Travelling to Gemba requires the clinical eye to determine the areas for enhancement of the production. To assist in this procedure, check sheets are available in a ready format that only requires information to conserve items. Essentially, saving more time is ideal. It is noteworthy that three primary categories of check sheets are present, with the selection of each sheet being in line with the objective of data collection.

Check sheet vs. checklist: In some cases, the check sheet is confused with a checklist. Examples of the checklist include the list for groceries and the record obtained from the auto repair shop with several items being ticked off after the service (tire pressure, oil, filter, and tread among others) are examples of a checklist. Several main distinctions between checksheets and checklists are presented as follows.

Check Sheet	Check List
A tally sheet for the data collection on the number of occurrences	An equipment employed to make sure that all the crucial stages have been performed
Custom made by the user	A standard version is mostly applied
One of seven quality components	Not one of the seven quality tools
E.g.: Check sheet to record the factors leading to disruption in OR	E.g.: All items in the case cart are presented prior to surgery in OR

When the check sheet is used: The use of check sheet is suitable during repeated observation and collection of data by either the same individual or place. It is also functional for the data collection on frequency and identification of trends of events, issues, deficiencies, damaged location, and defective cases.

A defining attribute of a check sheet is the recording of data by marking ("checks") it. A common check sheet is separated into regions, while the marks placed in diverse places hold various importance. The reading of data is made through observation of the location and amount of marks on the sheet. Five basic categories of check sheets are as follows:

1) **Classification check sheet**: An attribute including a deficiency should be placed under a classification. If the overall defects are monitored, a total of 101 deficiencies would be identified. Despite the usefulness of this information, it does not elaborate on the most unfavourable day or the most unfavourable form of deficiency worst among others. A classification check sheet offers an outline of the areas of the issue.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Wrong orders	///	𝍸	𝍸 𝍸 𝍸 𝍸 //	/	//	////	𝍸 //
Reworked orders		/	//	///		/	//
Late deliveries	𝍸 ///	/	///	//		///	//
Shipping damage						𝍸 𝍸 𝍸 𝍸	𝍸 ///
Late payments		/					
Totals	11	8	27	6	2	28	19

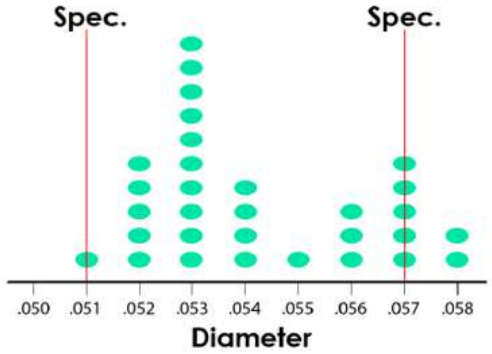
2) **Deficiency area check sheet**: The physical area of an attribute is presented through an image of an assessed item. Rather than simply monitoring the number of deficiencies, the defect location check sheet could show the region in the product where the deficiencies are often shown. Following this step, the team would be able to return to the procedure to observe what part of the upper right-hand corner of the product leads to the deficiencies.

3) **Frequency check sheet**: The availability or unavailability of an attribute or amalgamation of attributes is presented. Furthermore, the number of times when an attribute is present in a section could be shown. Upon tracking the number of defects, one may not notice that the Wrong Color shows the maximum

number of occurrences. If Wrong Color does not go through further division, one may not realise that the most deficiencies are present in GREEN.

Reason	Frequency	Comments
Label mismatch	//	
Label missing	/	
Incorrect label	///	
Wrong color	𝍸 𝍸 /	Green 𝍸 𝍸
Damaged label	/	Blue /
Other	//	

4) **Measurement scale check sheet**: A measurement scale is broken down into intervals, while measurements are represented through the examination of a suitable interval.



5) **Check List**: A list is made of the steps to be conducted for a task to ensure that each is achieved and could be indicated as completed.

6) **Important Tips for Using the Check Sheet**

   i. **Set your goals.** You have to establish exactly which event is being studied and set the goals of your data collection.

Imagine this situation: you are doing a search but you do not plan the collection of this data correctly. As a result, the energy, people and time that you spend in the end will serve no purpose. Before taking action, you should know exactly what data is needed and how it should be collected to ensure that you could later determine the factors leading to the issue.

ii. **Identify the type of check sheet**. Identify the appropriate type of check sheet and name it based on its utility. This step is extremely important, considering that if you do not have the correct sheet, you will not have the correct data and will have a so-called "false analysis". Although you can interpret that data properly, you will not know what to do with it.

ii. **Build a clear form**. It is necessary to build a clear and easy-to-handle form, making sure that all columns are clearly titled and there is enough space for the data to be recorded. The identification field of the person responsible for completing the sheet should not be overlooked. This form must be simple to facilitate collection.

iv. **Inform the people involved in the process**. Raise awareness to all individuals involved in the process of collecting data on the importance and purpose of this process and instruct them about the correct completion of the form. You have to tell all the employees who are on the production line that a team will measure what they are doing. It is also necessary to clarify that they have the complete freedom to propose ideas for the benefit of the company.

v. **Tell how, where, and when to collect**. This tip is crucial for the check sheet. You should inform all the people involved in the process regarding how, where, and when the collection

process is done. After all, "you should not go into other people's houses without an announcement!". Every team involved in the process under analysis should be aware that measurements will be taken and they must carry out the operations in the same way that they are carried out daily to ensure that the data collection describes the process as it happens in reality.

vi. **Make tests**. You need to be sure that all the stratification factors required for further analysis are present in the checklist. To identify any failure of elaboration, a pre-test should be performed before the use of the check sheet. To achieve good use of this tool, it is necessary that you follow all the required steps, making sure that they all are conducted in the correct manner.

5. Scatter Diagram

A scatter diagram or also called a correlation map is a graph that displays the relationship between two variables, whether the relationship between the two variables is strong or not, namely between process factors that influence the process and product quality. Basically, a scatter diagram is a data interpretation tool that is used to test how strong the relationship is between two variables and determine the type of relationship between the two variables, whether positive, negative, or no relationship. The two variables shown in the scatter diagram can be strong characteristics and factors that influence them.

Scatter Diagram or also called X-Y Graph, is a pair of numberic data (X and Y) with 1 variable on each axis to determine the relationships between them.

Scatter Diagram is a tool that functions to test how strong

the relationship is between 2 variables and determine the type of relationship. This relationship can be a positive relationship, a negative relationship or no relationship at all. The form of a Scatter Diagram is a graphical representation consisting of a collection of points from the values of a pair of variables (Variable X and Variable Y). In Indonesian, Scatter Diagrams are also called Scatter Diagrams.

Scatter diagrams are often also called scatter charts, scatter plots, scattergrams and scatter graphs. Case examples for testing the strength of the relationship between 2 variables include:

1. The relationship between machine speed and product quality.
2. The relationship between the number of workers and the output produced.
3. The relationship between the number of hours of machine failure and the level of defects that occur.
4. The relationship between Total Overtime Hours and the level of worker absenteeism.
5. The relationship between absenteeism and the level of product damage.

SCATTER DIAGRAM PATTERN

There are 3 patterns in a Scatter Diagram, namely:

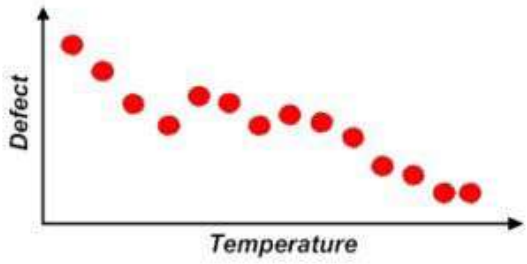
1. POSITIVE SCATTER DIAGRAM PATTERN, namely a pattern that shows a positive relationship or correlation between Variable X and Variable Y where the large values of Variable Small variable X corresponds to small values of Variable Y.
2. NEGATIVE SCATTER DIAGRAM PATTERN, namely a pattern that shows a negative relationship or correlation between Variable X and Variable Y where large values of Variable X.

3. THE PATTERN HAS NO RELATIONSHIP (NOT CORRELATION) Namely a pattern that is likely to have no relationship because there is no tendency for certain values in variable X to certain values in Variable Y.

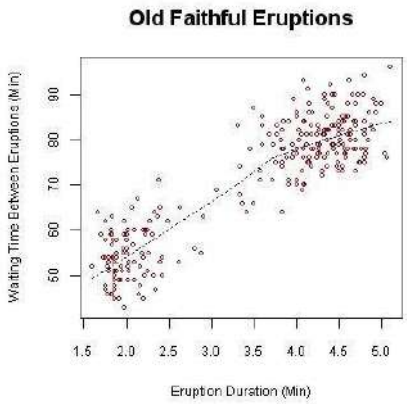
Scatter Diagram is a tool that functions to test how strong the relationship is between 2 variables and determine the type of relationship. This relationship can be a positive relationship, a negative relationship or no relationship at all. The form of a Scatter Diagram is a graphical representation consisting of a collection of points from the values of a pair of variables (Variable X and Variable Y). In Indonesian, Scatter Diagrams are also called Scatter Diagrams.

A scatter diagram is a graph that displays a pair of numerical data in a Cartesian coordinate system, with one variable on each axis, to see the relationship between the two variables. If the two variables are correlated, the coordinate points will fall along a line or curve. The better the correlation, the more closely the points approach the line.

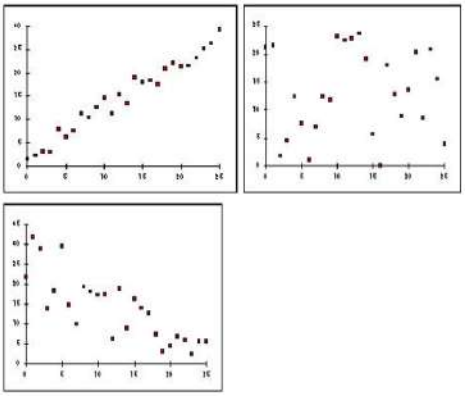
The image below shows an example of a scatter diagram used to see the extent to which temperature affects defects. It appears that there is a correlation between temperature and defects, where the higher the temperature the lower the number of defects, this may be due to a lack of engine warm-up process.



Scatter diagram is the ideal approach to presenting the values of two factors. It demonstrates the association between two factors and the outcomes on a Cartesian plane. Following that, more analyses, including trend analysis, could be conducted on the values. In these diagrams, one element indicates one axis while an additional factor indicates the other axis.



The Scatter Diagram is an additional Quality Tool that could be employed to demonstrate the association between "paired data" and is able to offer functional information regarding the steps in production. Following that, the term "cause-and-effect" association between two types of data could indicate the association between one cause and another or one cause and some other causes. An example could be the association between an element and the goods rigidity, between the cutting pace of a blade and the differences seen in the length of sections, or the association between the illumination degrees on the production floor and the errors occurring when the product quality is being inspected. To elaborate further, a number of instances of scatter diagrams are presented below, which show the associations between paired data.



Accordingly, the first diagram shows a significant association or link between the attributes. The second diagram features a moderate association, while the third diagram shows an adverse association indicating that one does not have contribution to the other. Based on the above instances, diverse associations could be seen among the dots, which are data points. Specifically, the strong association implies a strong link between the matched data. A somewhat distinctive pattern indicates the presence of relation, although this relation is not present in other conditions. The last diagram on the right implies the absence of relation between the paired data.

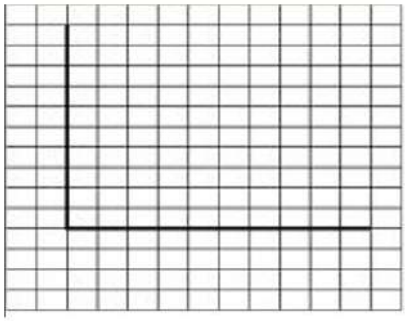
The first diagram on the left allows one to identify the solid relation. In this case, it could be proven that an item has a notable impact on the other. In the last diagram on the right, one could specify that no relation is present between the two items, leading to the necessity for reviewing the "brain-storming" session or "cause-and-effect" diagram to seek an additional element that could be related to the primary item subject to measurement. Following that, the middle diagram would create distress for an individual. Notably, the interpretation of this specific diagram is more challenging and needs a more thorough examination regarding the data points that correlate and the data that are not compared. In

this case, determining the factors to the revelation of relationship and vice versa is important.

The Directions of Creating a Scatter Diagram

In the case of Basic Scatter Diagram Layout, the availability of graph paper is important in designing a diagram. However, this article would demonstrate how this process takes place in spreadsheet form.

STEP 1 - Draw an "L" form. Develop your scale units at uniform multiples including 10 and 20 among others to gain a consistent scale system.



STEP 2 - On the horizontal axis (identified as the "X" axis, from Left to Right), the independent or "cause" factor is placed.

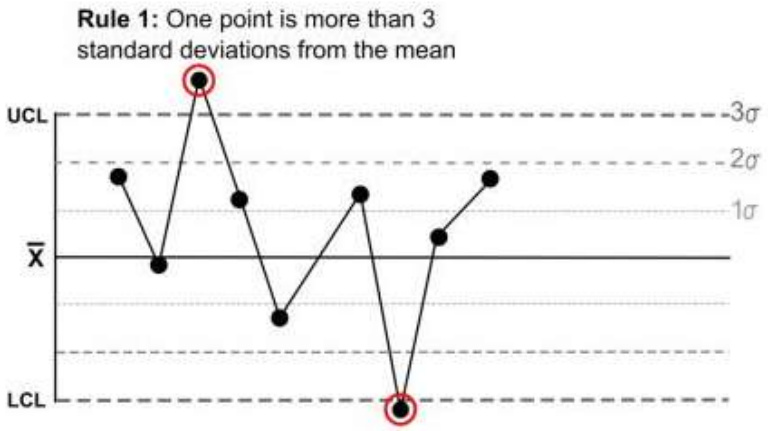
STEP 3 - On the Vertical axis (identified as the "Y" axis, from Bottom to Top), the dependent or "impact" factor is placed.

STEP 4 – Draw your data points at the intersection of your data plots of the X and Y values, such as = X = 5, Y = 2. Move right five spaces, and move up two areas to draw the point.

6. Control Charts

A Control Chart is a graph that provides an overview of the behavior of a process. This control diagram is used to understand

whether a manufacturing process or business process is running in controlled conditions or not. A process that is quite stable, but running outside the expected limits, must be repaired to find the root cause in order to obtain fundamental improvement results.



A control chart is a tool that is graphically used to monitor and evaluate whether an activity/process is under statistical quality control or not so that it can solve problems and produce quality improvements. Control charts show changes in data over time, but do not show the cause of deviations even though the deviations will be visible on the control chart. The benefits of a control chart are to:

1. Provide information on whether a production process is still within quality control limits or uncontrolled.
2. Monitor the production process continuously to ensure it remains stable.
3. Determine process capabilities (process capabilities).
4. Evaluate implementation performance and policies for implementing the production process.

5. Determine the criteria for product quality acceptance limits before marketing.

Control charts are used to help detect deviations by setting control limits:

1. Upper control limit (UCL) This is the upper limit line for a deviation that is still permitted.
2. Central line (CL) is a line that symbolizes the absence of deviation from the sample characteristics.
3. Lower control limit (LCL) is the lower limit line for a deviation from the sample characteristics.

Control charts were introduced by Walter A. Shewhart when he worked at Bell Labs (now better known as AT&T Bell Laboratories) in the 1920s. The company's engineers were working to improve the resilience of their telephone transmission system. Because signal boosting and other equipment must be buried underground, ways need to be found to reduce error and repair rates. In the 1920s engineers realized the importance of reducing variation in the manufacturing process. Moreover, they also realized that the repeated adjustment process as a reaction to non-conformities actually increased variation and reduced quality.

Shewhart separated these variations into general cause variations and special cause variations, and on May 16, 1924 he wrote a memo introducing control charts as a tool that could differentiate between the two variations.

George Edwards, Shewhart's superior, said: "Shewart made short notes, only a few pages. One third of the notes contained a very simple diagram, which is now known as a control chart." Shewhart emphasized the importance of having a statistically

controlled process, that is, a process that has only common causal variations.

A control chart consists of:

- Points representing a statistical value (average, range, proportion) of a sample characteristic taken from a process at different times (Data).
- The average of the above statistical values calculated from the entire sample.
- The center line is drawn exactly at the average of the statistical values.
- The standard error of the statistical value is also calculated from the entire sample.

The upper and lower control limits, which indicate the limit at which statistically a process can be said to deviate, are generally 3 times the standard error of the center line. Several features can also be added such as:

- Upper and lower warning limits, which are 2 times the standard error of the center line.
- Differentiated into several zones, if there are differences you want to see in different zones.

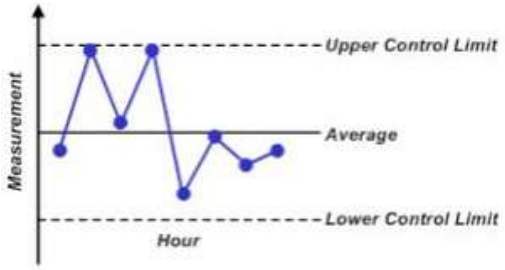
A control chart or control chart is a map used to study how the process changes over time. Data is plotted in time series. Control charts always consist of three horizontal lines, namely:

- Center line, a line that shows the middle value (mean) or average value of the quality characteristics plotted on the control chart.
- Upper control limit (UCL), the line above the center line indicates the upper control limit.

- Lower control limit (LCL), the line below the center line which indicates the lower control limit.

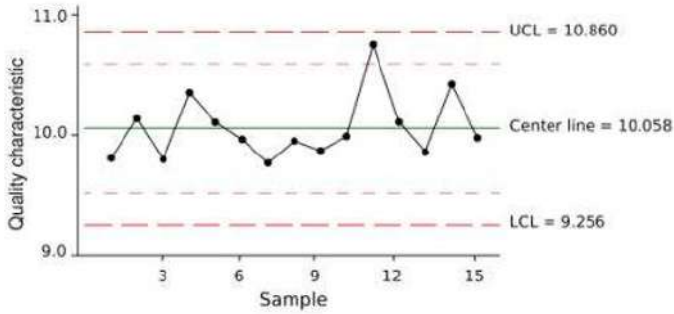
These lines are determined from historical data, sometimes the magnitude of the UCL and LCL is determined by the confidence interval of the normal curve. With a control chart, we can draw conclusions about whether process variations are consistent (within control limits) or unpredictable (outside control limits because they are influenced by special causes of variation, namely variations that occur due to factors outside the system).

The image below shows an example of a control chart. For types of control charts and how to make them, please open the post entitled: Statistical Process Control.

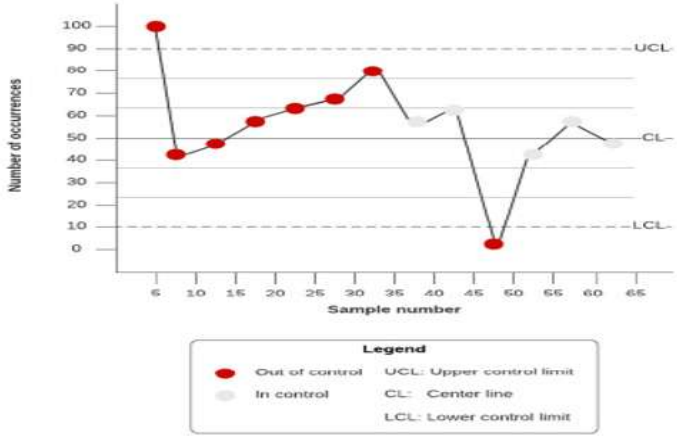


Control chart is the ideal equipment for keeping track of the condition of performance. These types of charts could be employed to monitor any procedures associated with the role of the company. These charts also allow the identification of the following factors linked to the observed procedure.

- Balance of the procedure
- Predictability of the procedure
- Determining the typical factor of differences
- Exclusive requirements where reaction from the monitoring party is needed



The control charts were developed by Walter A. Shewhart during his Bell Labs in the '20s and employed in diverse industries as parts of the process improvement methodology. This step led to the understanding by Shewhart that regardless of the quality of the process design, differences within the process would be present. However, an adverse impact would be present when the difference prevents the fulfilment of deadlines or quotas. In this case, it is important to take the initiatives to mitigate the differences with an adverse impact on your business, in which a control chart could benefit the organisation.



What is a control chart?

Known as a Shewhart chart in some cases, a control chart is a statistical process control chart or an SPC chart. It is among the graphical tools that are commonly employed in quality control analysis to build an understanding of the evolution of a process. The primary factors of a control chart are as follows:

- A visual time series graph that demonstrates the data points gathered at a certain timespan.
- A horizontal control line that facilitates the visualisation of trends and differences.
- Horizontal lines that represent the upper and lower control restrictions are positioned at the same distances on the higher and lower part of the control line. The calculation is performed on the aforementioned limits from the data, which is noted on the time series graph within a certain duration.

Advantages of the use of a control chart

Control charts are able to help individuals in the following matters:

- Understanding the differences that are constantly available in procedures. The differences in your control limits are the signs that the procedure is taking place. The differences that appear beyond your control limits represent the issues that require mitigation.
- Observing the possibility for issues to occur in a matter. These issue indicators would inform about the required corrective action.

- Identifying the pattern in the drawn points, which also denotes the probable factors that could assist in determining the probable resolutions.
- Making a prediction of prospective performance.
- Developing new ideas to improve quality in line with the analysis.

Building an understanding of process variation

Prior to the development of the control chart, the understanding of various categories of process variation is important to monitor and determine the stability of the procedure. The differences could be attributed to typical and distinctive factors.

Common cause variations

Common cause variations are constantly available in procedures and easy to predict. An instance could be the duration taken for commuting to work every morning. In this case, although one may commute through the same route, the drive would never be fixed. It is possible for the drive to require 20 minutes on average from the point where an individual has left the house until they arrive at the parking lot. As a result of common cause variations including traffic congestion and stop lights, the duration of the drive would be short on certain days or longer on other days.

Although it is not known by an individual the exact time when they will arrive at work on the next day, it is known that their arrival would be at a permissible time frame. Therefore, when variations remain within one's upper and lower restrictions, changing the procedure is not necessary as all things are functioning based on prediction.

Special cause variations

Special cause variations are normally irregular and cannot be predicted. Examples of such variations are the exhaustion of gas, failure of the engine, or a flat tire, which could make the duration of commuting an hour longer or more. However, these categories of special causes do not occur on daily basis. Furthermore, with the occurrence of special cause variations, analysing the issue is ideal for observing whether the prevention of these anomalies could be made henceforth. In the commuting instance, one should ensure that they have arrived at a petrol station when the car is facing a shortage of gas and their vehicle has received good maintenance to function properly.

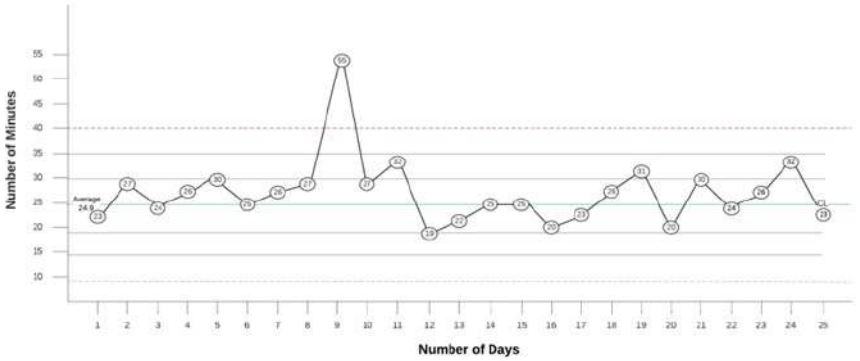
Directions for creating a control chart

Control chart is an effective method of separating common cause variations from special cause variations. As a result, it is possible to assess a process variable throughout the period. Accordingly, these actions could be performed:

1. Make a decision on duration by marking on the X-axis of the control chart to gather the crucial information and develop control limits.
2. Gather the information and draw it on the control chart.
3. Make a calculation of the data average and include a control line.
4. Make a calculation of the upper and lower control limits and include these lines into your chart, preferably in diverse colours or manners.
5. Consider the "out-of-control signals" or areas in which your information is placed beyond your control limits. Determine the factors and adapt the procedures to reduce the predicament of these abnormalities.

6. Proceed with the procedure while reminding yourself of the control limits.

An example is when an individual attempts for recording the duration required for commuting to work on a daily basis for several days. In this case, the duration taken from the moment one leaves the house until they arrive at the parking space is recorded. Following the plotting of data on a control chart, the calculation of the average time required for commuting is possible. The following control chart is a straightforward visual aid illustrating the duration taken for commuting over 25 days.



Based on the example in this study, data collection was conducted for 25 successive days. The calculation of the mean minutes implies that 24.9 minutes on average is required for a trip of a single day. This average duration would be the control line (CL) highlighted in green.

Method of Calculating The Upper and Lower Control Limits

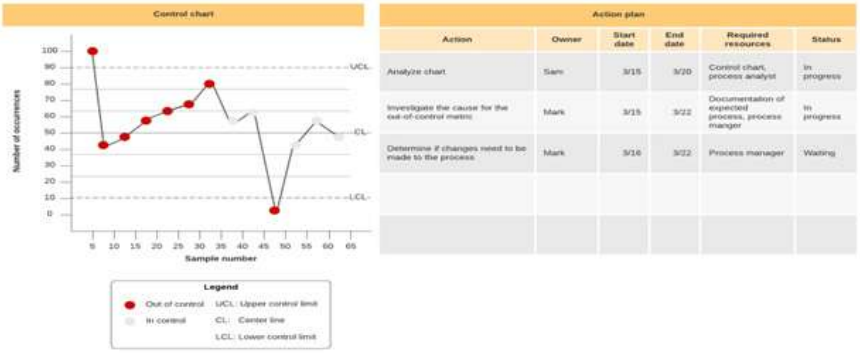
Following the calculation of the mean is the calculation of the control limits. The upper control limit (UCL) is the maximum duration one would predict the commute to need during the occurrence of typical causes. Meanwhile, the lower control limit (LCL) is the minimum value that the commute is predicted to require with typical factors of variation.

Following are the stages for calculating the control limits:

1. Make a subtraction of the mean amount from the obtained number daily, followed by squaring the outcome. (e.g., the calculation of Day 1 would amount to 23 - 24.9 = -1.9 x -1.9 = 3.61.)
2. Determine the mean of all the outcomes that have gone through squaring.
3. Determine the square root of the outcome, which is the standard deviation.
4. Find the number of standard deviations that should be placed under your controlled process. The upper and lower limits in a properly managed procedure amount to +3 and -3 mean standard deviations.

As a result, a standard deviation of 6.9 is obtained. The upper control limit amounts to 45.6 minutes (24.9 + 6.9 + 6.9 + 6.9), while the lower control limit amounts to 4.2 minutes (24.9 - 6.9 - 6.9 - 6.9), as indicated in red on the control chart example.

Considering that the entire points drawn on the chart are in the control limits, the procedure is regarded to be in statistical control, which is a favourable condition where no changes are completely necessary. Although making improvements is acceptable, working within the control limits is an ideal objective. Meanwhile, the points beyond the control limits denote the moments when the process is outside control. If the occurrence of this condition is low, observation is important to conduct an analysis of the related issues and resolve them in the future. However, the pattern when the process is frequently outside the control points should be resolved.



Once you are prepared to conduct process optimisation, enhance the quality, and end the variation in its paths, you can proceed with the control chart template.

7. Pareto Charts

A Pareto chart is a chart that contains a bar graph and a line graph; Bar charts show data classifications and values, while line charts represent cumulative data totals. Data classification is sorted from left to right according to highest to lowest ranking order. The highest ranking is a priority problem or the most important problem to be resolved immediately, while the lowest ranking is a problem that does not need to be resolved immediately.

The Pareto chart principle is in accordance with Pareto's law which states that a group always has the smallest percentage (20%) that is valuable or has the greatest impact (80%). The Pareto chart identifies 20% of the causes of vital problems to realize 80% overall improvement. The image below shows an example of a Pareto chart.

Pareto is a bar graph that shows problems in order of the number of events. The order starts from the number of problems that occur the most to the problems that occur the least frequently. In the graph, it is shown by the highest graph bar (far left) to the lowest graph (far right).

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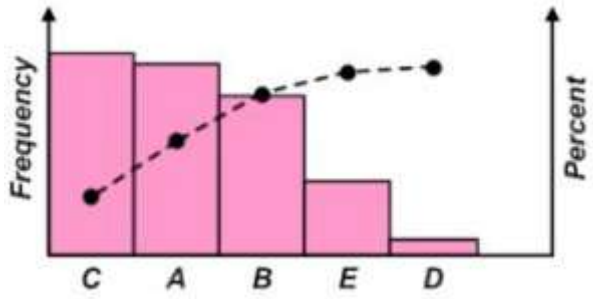


The use of Pareto charts is for determining a set of priorities. You are able to chart any amount of issues/variables associated with an issue and note the number of occurrences. Through this approach, you will be able to determine the parameters with the most notable outcome on the specific concern. Subsequently, you will also be able to address the propriety concerns to maintain a controlled state.

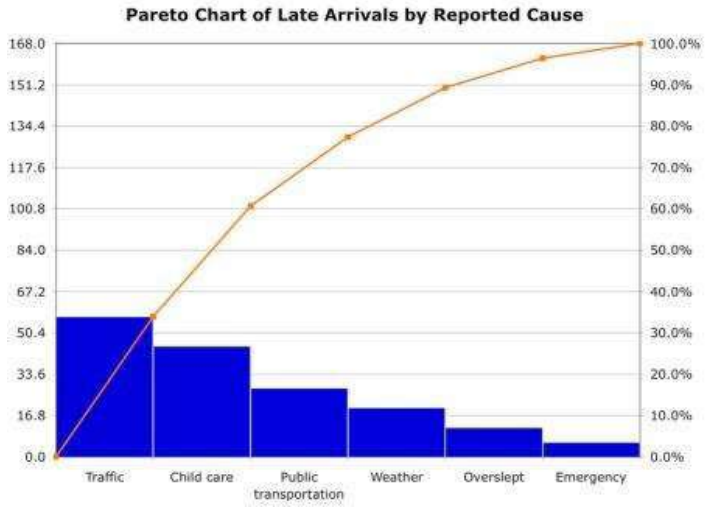
Yemima (2014) explains that the Pareto diagram was first introduced by Alfredo Pareto and first used by Joseph Juran. Pareto diagrams are bar graphs and line graphs that illustrate the comparison

of each type of data to the whole. By using the Pareto diagram, you can see which problems are dominant so you can know the priorities for solving the problem.

The function of the Pareto diagram is to identify or select the main problems for quality improvement from largest to smallest. The uses of the Pareto diagram are:

1. Showing the main problem.
2. State the comparison of each problem to the whole.
3. Shows the level of improvement after corrective action in a limited area.
4. Show a comparison of each problem before and after improvement.

Pareto diagrams are used to identify several important problems, to find the biggest and most influential defects. Searching for the largest defect or the most influential defect can be useful for finding several representatives of the identified defects, which can then be used to create a cause and effect diagram.



A Pareto chart is a tool that enhances quality in line with the Pareto principle, in which 80% of a result originates from 20% of its inputs. Vilfredo Pareto, an Italian engineer and economist, made the first observation of the 80/20 rule in terms of wealth and population. At the start of the 20th century, Pareto stated that 80% of the wealth was managed merely by 20% of the population in Italy and some other European nations.

The 80/20 Rule

It could be seen that this 80/20 rule is applicable to various systems:

- In transportation, 80% of the delays are possibly attributed to 20% of the probable factors.
- In business, 80% of the revenue could originate from 20% of the products or 20% of the customers.
- In a manufacturing procedure, 80% of the downtime could be attributed to 20% of the issues.

A Pareto chart is among the primary tools employed in the six sigma methodologies and comprehensive quality control. Essentially, it is a bar chart demonstrating the extent to which every factor leads to a result or impact. The length of every bar denotes the "cost" (in time, number, or money) of every cause, with the longest and shortest arrangement applied to the bars to visually highlight the most prominent or important factors.

Using Pareto Charts for Quality Control

Pareto charts could be employed in various manners, which include the following:

✓ To conduct analysis on the occurrence of issues or deficiencies in a procedure

- ✓ To conduct an analysis of the broad causes by investigating each element
- ✓ To emphasise the initiatives on the issues with the most significance or numerous causes
- ✓ To help communicate the significance of problems or causes to others

Stages in Developing a Pareto Chart

The following stages are involved in developing a Pareto chart:

1. Develop an Objective

The first stage in the development of the Pareto chart is to develop its objective. In this case, the result or impact of interest is taken into account. However, this condition could disrupt a manufacturing procedure, customer dissatisfaction towards a service provider, or late deliveries for a shipping company.

2. Identify the Factors and Measurement

It is important to determine and classify the factors and the suitable measurement accordingly. Time, number, cost, and frequency are the common measurements.

3. Identify the Timeframe

Identify the timeframe for the chart. Do you wish to observe the data by shift, day, week, or month?

4. Data Collection

Decide on the method of data collection, which includes hand, the use of a spreadsheet, or data historian, which is the easier approach. With an easier approach, the causes would have a better definition. A number of data historians and PIMS enable the entry

of Pareto variables to manage the disruption and assist in production loss analysis.

5. Data Analysis

Make a calculation of the subtotal for every factor in the selected timeframe. You are able to make the calculation of the percentage contributed by each factor, which would amount to its subtotal that goes through division by the total for the entire factors. Following that, a percentage scale could be plotted opposite the measured value scale.

6. Develop the Chart

The chart is developed, with the list of the factors being made on the x-axis and measurement units on the y-axis. Position the factor with the longest bar at one side, while the other bars are arranged in descending order (if you have some extremely small bars, you can classify them under one small bar marked as "Other").

In most cases, cumulative percentage curves are drawn on Pareto charts. In this case, a dot can be created at the percentage the first cause contributes in the first bar. At the second bar, the first percentage is incorporated into the second percentage, followed by the placement of the second dot at the amount. Then, the third percentage is included in the previous amount for the placement of the third dot. The same step repeats for the next percentages. The final dot should be at 100% on the percentage scale. Lastly, the dots are connected to gain a cumulative percentage curve.

Chapter 6
Another Quality Management Tools

A. Toyota productive system

The Toyota Production System (TPS) is an integrated socio-technical system established by Toyota and includes management principles and applications. The TPS is a management system that arranges logistics and manufacturing for the automobile manufacturer, which involves the exchange with consumers and suppliers. Established by Taiichi Ohno and Eiji Toyoda, Japanese industrial engineers, between 1948 and 1975, the system is a primary pioneer of the more common "lean manufacturing". It was also originally known as "just-in-time production" and is built on the method developed by the founder of Toyota, Sakichi Toyoda, his son Kiichiro Toyoda, and the engineer Taiichi Ohno. The principles that have become the basis for TPS are implemented in The Toyota Way.

In comparison to other factors of the organisation, this system plays a role in the development of Toyota until its current state as an organisation. Besides, Toyota has been acknowledged as the leader in the production industry and automotive manufacturing for the long term. The Toyota Production System offers empowerment

to the team members to increase the quality through constant improvement in procedures and removal of unneeded waste in natural, corporate resources, and human. Notably, TPS impacts each factor of Toyota and comprises typical processes, values, and knowledge. It also assigns the workers with properly defined roles in every production step and provides encouragement for the team member to pay effort towards enhancement.

Toyota is inspired by the system from the visit to the supermarket rather than the American automotive industry although this industry currently is the most prominent. The notion of just-in-time production was initiated by Kiichiro Toyoda, the founder of Toyota, particularly on the methods of applying the idea. When the details of American supermarkets were examined, Ohno perceived the supermarket as the model for the matter that he attempted to achieve in the factory. A customer in a supermarket obtains the targeted quantity of goods off the shelf, followed by purchasing the goods. The restocking of the shelf takes place with an adequate number of new products to fill in the shelf space. Similarly, a work centre that requires the components would visit the "store shelf" (the inventory storage point) for the specific part and "purchase" (withdraw) the required amount. Then, the "shelf" would go through "restocking" by the work centre that creates the component, which would be adequate for the replacement of the extracted inventory.

Although low inventory degrees are the primary result of the system, a crucial factor of the philosophy behind its system is to function with effectiveness and remove waste to ensure that the minimum inventory is required. Following the observation of Toyota factories, numerous Western businesses aim to directly assault high inventory degrees without understanding the factors

contributing to the possibility of the reduction. Imitation without a comprehension of the essential concept of motivation could create failed projects.

Toyota Motor Corporation established its first official description of TPS in 1992. The revision of this booklet was made in 1998. It was mentioned in the introduction, "the TPS is a framework for the conservation of resources through the removal of waste. Individuals who are involved in the system would be informed of the methods to determine the expenditures of material, time, and effort that do not create value for customers. Besides, the 'how-to' method is avoided. Furthermore, instead of a manual, the booklet is an overview of the concepts that become the basis of the production system. It also reminds of the possibility for lasting gains in efficiency and quality at any time and place where the unity of the management and workers takes place to bring a positive change". TPS is based on the following two primary conceptual pillars:

1. Just-in-time, which indicates "creating only what is necessary, when it is necessary, and with the necessary number".
2. Jidoka (autonomation), which indicates "automation with a human touch".

Toyota has made the development of diverse components to implement these concepts into conditions and specifications in the organization and establishment. Notably, the impacts on process value delivery with the highest significance could be gained by creating a process that could swiftly deliver the results by designing out "mura". It is also important to create an adaptable procedure without "muri" (excessive burden) as it could lead to "muda" (waste). It is also noteworthy that the tactical enhancements of waste reduction or

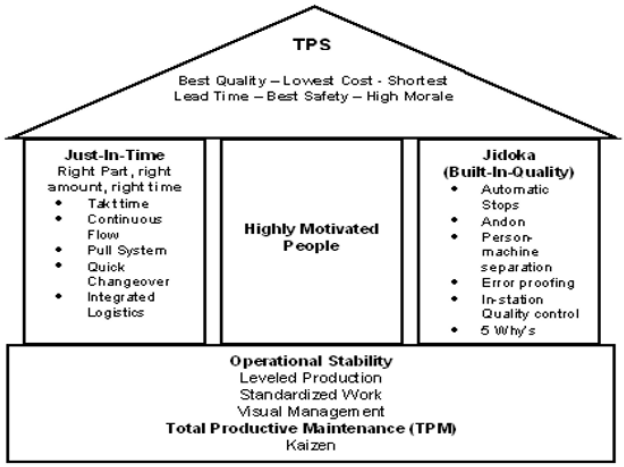
removal of muda hold high values. The primary purposes of the TPS are to design out irregularity (mura) and excessive burden (muri) and to remove waste (muda). A total of eight types of muda are approached in TPS:

- Waste of excessive production (largest waste)
- Waste of time on hand (waiting)
- Waste of transportation
- Waste of process
- Waste of inventory
- Waste of movement
- Waste of defective products
- Waste of underused workers

Waste removal has dominated the perception of many upon their observation of the impacts of TPS, considering that it is the most common for implementation. In the TPS, numerous initiatives are attributed to irregularity or decrease in overrun, which forces out the waste with no particular emphasis placed on the reduction.

1. TPS House

The TPS-House is arranged in three sections and presents the components of a lean system. It also demonstrates the basics on the bottom, the pillars that denote the core activities. Meanwhile, the roof of the house presents the objectives of the Toyota Production System.



14 Concepts of Toyota Production System (TPS)

Concept 1: Set the long-term philosophy as the basis of your management decisions even if the short-term financial objectives are placed at risk.

- Develop a philosophical dedication that exceeds any short-term decision-making. Work, develop, and position the entire company towards a mutual objective that is more significant than generating money. Gain an understanding of your place in the history of the organisation and make effort to increase the level of the organisation. Your philosophical mission is the basis for other concepts.
- In the beginning, create value for the customer, economy, and society. This is followed by an evaluation of the function of the organisation, specifically the capability for it.
- Take on responsibility and make decision about your fate. Perform with self-reliance and believe in your capabilities. Be responsible for your own action and continue improving the expertise that allows the generation of added value.

Concept 2: Develop a constant flow of procedures to highlight the issues.

- Redevelop a work procedure to gain significant added value and constant flow. Make an effort to reduce the idle period of the work project to zero or wait for people to operate on it.
- Develop a flow to mobilise the data and material at a fast rate to connect the procedures and individuals in an effort to identify the issues promptly.
- Demonstrate the flow throughout your organisational culture, which is an important factor in achieving constant enhancement and people development.
- Offer your downline customers in the production what they desire, when it is desired, and the quantity they prefer. Material replenishment is made through the use of the essential concept of just-in-time.
- Reduce your ongoing work and warehouse inventory by supplying a low quantity of every product and often resupply according to what is taken by the customer.
- Frequently show response to the daily changes in customer demand instead of being dependent on computer schedules and systems to identify excess inventory.

Concept 3: Use the "Pull" system to avoid overproduction.

- Offer your downline customers in the production what they desire, when it is desired, and their preferred quantity. Material replenishment begins with its use in the essential concept of just-in-time.

- Reduce your operation and warehouse inventory by supplying a low quantity of every product and often resupply according to what is taken by the customer.
- Frequently show response to the daily changes in customer demand instead of depending on computer schedules and systems to identify excess inventory.

Concept 4: Equalise the workload (heijunka). ("Work like a tortoise, not the hare.")

- Waste removal is merely one-third of the equation of succeeding in learning. However, the removal places an excess burden on individuals, tools, and removal of inconsistency in the production schedule. Although this factor holds the same importance, it is not comprehended in organisations that attempt to apply lean principles.
- Make an effort to equalise the workload of all service and manufacturing procedures as an alternative choice to the start/stop method of operating projects in batches, which is common in the majority of organisations.

Concept 5: Develop a culture of ending the solution to issues for the first achievement of quality promptly.

- Customer quality fosters value proposition.
- Apply all the existing modern quality assurance approaches.
- Develop the ability of identifying issues and putting a stop to the equipment. Create a visual system to caution the project or team leaders that a machine or procedure needs to be assisted. Jidoka (machines with human intelligence) is the basis for "developing" quality.

- Develop support systems in an organisation to find solutions to the issues promptly and apply countermeasures.
- Develop into your culture the beliefs of ending for the first achievement of quality to improve productivity for the long term.

Concept 6: Standardised tasks become the basis for ongoing enhancements and empowering the employees.

- Employ stable approaches that could be repeated at any place to retain the foreseeability, regular timing, and common output of your processes. It is the foundation for the flow and pull.
- Gain the accumulated learning regarding a process to an extent through the standardisation of the current ideal practices. Enable the creative and individual expression to enhance based on the standard, followed by its incorporation into the new standard to ensure that you are able to transfer the learning to the next individual.

Concept 7: Apply Visual Control to ensure that there is no hidden issue.

- Employ simple visual indicators to assist people in promptly determining whether they are in a quality state or drifting away from it.
- Prevent the use of computer screens when it shifts the worker's focus from the workplace.
- Create a simple visual system at the workplace where the operation is performed for supporting the flow and pull.
- Decrease the number of your reports to a piece of paper when there is an opportunity even for your most crucial financial decisions.

Concept 8: Employ solely the reliable, completely tested technology that caters for your people and process.

- Employ technology as a way of supporting individuals instead of replacing them. In most cases, a manual operation of the process is simpler before the incorporation of technology as a way of supporting people.
- In most cases, the emerging technology is not reliable and its standardisation is challenging, which risks the "flow". A proven process that has a general operation outweighs the emerging technology that is not tested.
- Perform the real tests prior to the adoption of new technology in business procedures, manufacturing systems, or products.
- Refuse or adjust the technologies that are against your culture that could be a disruption of balance, dependability, and foreseeability.
- Motivate your people to employ new technologies upon observing new methods to work. Make a fast implementation of technology that is completely taken into account if it has been shown in trials and could enhance the process flow.

Concept 9: Cultivate leaders who have a thorough understanding of the work, live the belief, and spread it to other people.

- Cultivate the leaders instead of purchasing them from outside the company.
- Do not perceive the leader's responsibility as merely fulfilling the tasks and gaining positive expertise. Leaders should be the mentors for the organisation belief and the method of conducting business.

- A leader should have a thorough understanding of the daily work to ensure that they could be the ideal mentor of your organization philosophy.

Concept 10: Establish exceptional individuals and groups who are following your organisation belief.

- Develop a unique and balanced culture where organization values and philosophies are distributed and last for many years.
- Provide training for outstanding individuals and groups to operate in the corporate philosophy to gain outstanding outcomes. Pay significant effort to reinforce the culture continuously.
- Employ cross-functional groups to enhance productivity, quality, and flow by finding a solution to challenging technical issues. Empowerment takes place solely upon individuals' use of the organization equipment used for its improvement.
- Give a continuous effort as a way of teaching individuals about the method of working as teams towards common goals. The learning about teamwork is important.

Concept 11: Respect your increased network of suppliers and partners by providing challenges and assisting in their improvement.

- Show respect to your suppliers and partners, and regard them as a way of extending your business.
- Set challenges for your outside business partners for your development to demonstrate its worth for you. Establish the challenging goals and provide assistance to your partners to achieve them.

Concept 12: Arrive at gemba and make self-observation to gain a thorough understanding of the situation (Genchi Genbutsu).

- Find a solution to the issues and enhance the procedures by arriving at the origin and making personal observations and verification of data instead of making theories on the basis of what is told by people and the computer screen.
- Reflect and elaborate following the personally verified data. This case also involves high-level managers and executives to observe on their own and ensure that they gain more than surface-level comprehension of the situation.

Concept 13: Gradually decide by agreement (employ cross-functional teams), thoroughly consider all choices, and apply the decisions at a fast rate.

- Do not choose to go in a single direction until all the alternatives have been taken into account.
- Nemawashi denotes the procedure of discussion about possible issues and solutions with all the impacted parties to gather their ideas and obtain consensus on a path ahead. The process of the agreement throughout time involves the consumption and broadening of the identification of solutions. When the decision-making has taken place, the application is determined to be made at a fast rate.
- Upon the establishment of a balanced procedure, ongoing improvement tools are employed to identify the factor leading to incompetence and implement functional countermeasures.
- Develop procedures where nearly no inventory is needed, which would reveal the excess time and resources. Upon the exposure of waste, an ongoing improvement procedure (kaizen) is employed for its elimination.

- Offer protection to the organisational knowledge base through the development of balanced personnel, gradual promotion, and highly attentive succession systems.

Concept 14: Develop a learning company using persistent reflection (hansei) and ongoing enhancements (Kaizen).

B. Lean

Lean Manufacturing

What is Lean Manufacturing? Established in Japan after World War II, Lean Manufacturing is currently employed worldwide. Lean Manufacturing is basically an ongoing or repeated system of enhancement, in which one makes continuous improvements or attempts to improve the methods of performing specific responsibilities. Furthermore, it is a system of ongoing enhancements in procedures, quality, technology, security, efficiency, company culture, workforce characteristics and features, including leadership.

The success of a strategy is not only seen from the product's position against competitors in the market, it is not only about how many products are successfully sold. But it is also about the internal conditions of the company, namely how the product is made, how many resources are used, how much time and costs are used to make the product.

In the production process, if a process does not provide added value to the products produced by the company then this process can be categorized as waste. Waste that occurs in a company will result in wasted energy or resources used, thereby minimizing the profit value that will be obtained by the company later. In reducing this waste, one approach that can be taken is to apply the Lean Manufacturing concept in the company environment.

Lean Manufacturing is a production practice that considers all expenditures of existing resources to obtain economic value for customers without any waste, and this waste is the target to reduce. Lean Manufacturing is a management method and strategy to increase efficiency in manufacturing or Lean production always looks at product value from the customer's perspective, where the value of a product is defined as something that the customer is willing to pay for. The main goal of Lean is to eliminate waste and increase the added value of products (goods or services) in order to provide value to customers.

The implementation of Lean Manufacturing is carried out continuously to create improvements in processes and innovation in the company, so that the company makes continuous improvements to achieve operational excellence and customer intimacy.

The essence of Lean includes the improvement in each aspect of your business by making a constant effort to make more systematic actions without deficiency. Some of the essential tenants of Lean Manufacturing are as follows:

- Kaizen is one of the main philosophies in Lean Manufacturing. In Japanese, "Kai" denotes fixing, correcting, improving or changing, while the word "zen" denotes goodness. This aspect is the essence of the philosophy of ongoing enhancement. Although is not a "process" that is made at a common interlude, it is conducted continuously.
- 5S is a systematic method of workplace organisation. It involves a five-step process that establishes the effectiveness, continuation, and competitiveness of your organisation.
- 6S obtains the 5S system and proceeds further. Despite the importance of the entire steps of 5S, another "S" is also crucial: Safety.

- Six Sigma is a procedure employed to enhance the overall standard of production output. It is developed to decrease the causes of variation and deficiencies in manufactured products, and its functionality is dependent on some other quality management procedures.
- Zero Defects is another Lean Manufacturing belief that emphasises increasing quality, which is a key to successful businesses or manufacturing companies.

Currently, numerous other lean manufacturing beliefs and approaches are employed around the world. To gain further information on Lean Manufacturing, a wide range of Lean Training Videos and Lean Manufacturing Tools and other 5S products that could be useful have been provided.

1. Kaizen

Kaizen is a Japanese term that went through coinage after World War II when businesses were coping with the impacts of the war. "Kai" means "change", and "zen" means "good". Fundamentally, this term means "continuous improvement" and it aims toward human resources and procedures for anchoring an industry for an effective operation that lasts long. Kaizen has led to important outcomes for organisations including Toyota and is a renowned production belief worldwide.

In Lean manufacturing, Kaizen is the action of consistently adding subtle enhancements to increase safety, productivity, and efficiency in a workplace. This fundamental Lean manufacturing approach creates consistent enhancement of the fabric of one's organisation culture, which indicates that team leaders, managers, and employees would perform a constant search for methods to enhance procedures and increase the standards. Kaizen reviews and training inform new

workers regarding the method of applying Kaizen principles to their work, which indicates the consistent sustainability of Kaizen in the future.

Consistent enhancement is the procedure of always optimising the condition of a subject than its original condition. Accordingly, Kaizen could be described as the belief and application of the consistent enhancement. It also denotes the application of determining the methods to enhance work procedures on a regular basis, which features minor and gradual changes instead of significant changes. With Kaizen, all individuals in the company identify the chances for enhancement instead of merely managers or executives.

Without Kaizen	With Kaizen
No form of the enhancement procedure, a small set of processes. No definition is provided to the objectives or the measurement of the definition is challenging. The changes made to the procedures are not frequent; their efficacy is not strongly reflected. A plan for enhancement is not employed, which is unsystematic.	Consistent, ongoing process of improvement takes place. The improvement process has clearly defined, measurable goals. A consistent review of successes is made, followed by an evaluation of the enhancement procedures. Constancy of the procedure creates new and bigger goals.

Kaizen Philosophy

According to Masaaki Imai, the East and West showed different methods of employing the notion of Continuous Improvement. Imai stated that the gradualist approach is applied by the Japanese in the east, which is known as Kaizen. It was also added that Western businesses employed the great-leap-forward methodology, which was described as Innovation. The Eastern model of minor and gradual change focuses on the broader view. Although these changes appear

to not be significant upon implementation, they could lead to notable enhancements. Furthermore, this model emphasises the long-term. Imai elaborated that the Eastern model of enhancement takes small initiatives for the constant, gradual, and long-term development. Every party in the organization is involved in this model and collaborates for maintenance and improvement. This method was perceived by Imai as low investment and required significant effort for maintenance, although he viewed it as more ideal for gradual economic development.

In the Western model of enhancement, the outcomes are expected to appear at a fast rate. Subsequently, significant changes that lead to fast outcomes are often applied. The positive side of this approach is examined promptly, which often satisfies organization leaders and offers an incentive to workers. However, the drawback is backsliding, considering that companies constantly apply unpredictable significant changes while the enhancements would reduce throughout time. According to Imai, the Western model of enhancement involves notable progress in the short term with unpredictable changes. Additionally, the West employs a small number of individuals in the organization and individuals who perform scrap and rebuild. This method was perceived by Imai as having a high investment albeit significant effort is not required for maintenance. It was also seen as more ideal for economic growth.

In the case of Kaizen, it is under the Eastern model for enhancement in most cases. To illustrate, minor changes occur regularly and they could offer a business various advantages. Individuals are able to conduct tasks with more efficiency, make changes on their own, and determine the actual methods of assisting the business. Subtle changes could be useful due to their tendency to be less costly and their implementation is simple. However, if a

change is not effective due to certain factors, no significant damage takes place as a small number of resources have initially gone through the change.

Following are the advantages of Kaizen in companies:

1. More swift and efficacious procedures
2. Higher cleanliness and security at workspaces
3. Products and/or services of better quality
4. Lower cost
5. Enhanced employees' confidence and involvement
6. Improved customer service

In Kaizen, respect for all employees is important to ensure that they could make recommendations on process enhancements comfortably. Therefore, it is indicated that the management should trust the workers' capability of creating changes. Considering that individuals have more familiarity with their work compared to others, they possess the understanding of the potential enhancements that are otherwise not possessed by individuals who do not perform the task every day. Notably, when individuals are required to identify these enhancements as a component of kaizen, they are not supposed to seek cost savings. Although several enhancements may not contribute to direct cost savings, they could facilitate the process or improve the environment for the individuals within it.

It is important to seek enhancements for people's work function, which could also assist the organisation and its consumers. Individuals should be motivated to attempt at the ideas and create necessary changes. It is possible for the workers to seek guidance from the co-worker or supervisor beforehand or proceed with the implementation

of the idea if it is adequately small to observe the outcomes. However, this condition depends on the workplace policies as several facilities recommend the workers to constantly seek guidance from the supervisor before attempting an idea. Overall, workplaces that employ Kaizen believe that individuals would attempt certain actions and are not constantly reliant on others during decision-making.

Role of Management

Management holds a crucial role in Kaizen effectiveness, which is as follows:

- ✓ Finding the methods of improving their own work
- ✓ Retain and increase standards
- ✓ Offer objectives and aims for enhancement
- ✓ Underpin actions with proof

Each workplace has its respective uniqueness, in which the techniques that assist in the improvement in a facility may not be effective in another. The management role is to provide sustenance to individuals upon the testing of the techniques and offer general instruction on the direction of the company. With the changing standards, management must ensure that all individuals have awareness of these changes and ensure that documentation about them is made. Upon the management decision for implementing a change, presenting data for support assists the buy-in process from other parties in the company. To illustrate, individuals do not perceive the management to make uncalculated decisions. Employees are able to observe the changes being deliberately made to set advanced objectives of the company.

Equipment of Kaizen

Although the purpose of Kaizen is to increase effectiveness and productiveness, it promotes a positive working environment for workers. This condition develops an arranged work environment with creativity that enhances the organisation, workers, and the services provided to the consumer. Kaizen functions in a cycle where collaboration is required in all departments and may reach the suppliers.

1. PDCA Cycle

An important instance of Kaizen is the application of a procedure known as the PDCA cycle, which is also known as the Plan, Do, Check, Act approach. The first stage of PDCA is the implementation of the plan and collection of data that would be subsequently applied for comparisons. The acquired outcomes are examined, followed by a comparison with the expected output. Following that, discussion and refinement are performed on the outcomes to develop a new plan. The implementation of a new plan is the final stage of the cycle, which is repeated with examination and data collection. With the repeating process and quantifiable data, the enhancement could be achieved in every stage. Notably, PDCA is a recurring approach that increases the knowledge of the production procedures and leads to enhancement, making it an ideal instance of Kaizen.

2. Quality Circles

The factors include self-discipline, teamwork, recommendations, enhanced morale, and quality circles. Although these terms are simple overall, "quality circles" is a new term to many individuals.

Circles denote the groups that emphasise the identification, analysis, and suggestion of solutions to address issues. It consists of

students and/or workers with a team leader and contributes to the development and presentation of individual ideas instead of the delegation of individual jobs. This element facilitates the highlight of the solutions to issues instead of blaming other parties when errors occur. Japanese businesses commonly regard a production line as a recognised quality circle. In this case, the issue could be promptly identified in the production stage, which could decrease the main issues. Training on troubleshooting abnormalities in the work station is offered to every employee. With the execution of quality control in the station, an impactful decrease in expenditure and time could be achieved. Quality Circles and Suggestions are two of the main forces behind the success that Toyota has had with Kaizen.

3. 5S

Kaizen is developed on a 5S framework with the removal of waste and standardised forefront. 5S presents a solid basis for upcoming Kaizen activities and develops a company system that allows all individuals in the workplace to be involved in removing the clutter and setting the spaces with convenience. While 5S is used for cleaning and organising space, managers must motivate the frontline workers and operators to present recommendations for enhancement. Notably, this type of system assists an individual in identifying chances for enhancement while encouraging self-discipline and cooperation.

4. Kaizen Events

Despite the choice of numerous organisations to apply the Kaizen philosophy in their daily activities, Kaizen events could be convenient for larger-scale projects. Also known as a Kaizen blitz, a Kaizen event is an organised enhancement procedure that occurs in a few hours, days, or extended to one or two weeks. An event team is developed and allocated a focus.

Kaizen events are employed for several methods, which include changes in the process, layout changes in the facility, standardisation, and waste removal. The ultimate establishment of the scope of a Kaizen event is a primary factor contributing to an effective blitz. In most cases, although enhancement projects begin with a rational scope, the size of the projects has increased to the extreme and become demanding. During the planning phase, the Kaizen team will need to choose an area or process for improvement and identify the scope of the event.

5. Kaizen and Constant Enhancement

The Kaizen mindset of constant enhancement increases the productivity and efficiency of the workplace through the implementation of gradual changes and emphasis on employees' participation. Kaizen develops a constant procedure for enhancement, describes the organisation objectives, and offers managers the components required to achieve the objectives.

2. 5s system

With the constantly developing economic climate, numerous companies are recurrently making adjustments to the resources in line with the business strategy. In most cases, this condition leads to the importance of achieving further work with a smaller number of resources. To maintain success, businesses should increase efficiency, decrease waste, and cut down costs. Furthermore, determining the methods of improving current activities in a short duration and reduced cost is important, which could be achieved through the application of 5S Principles.

Notably, 5S Principles show high effectiveness in the identification and elimination of waste and rising effectiveness. A high volume of information is present regarding 5S. According to common beliefs,

the establishment of the 5S Methodology in Japan is due to the letter "S" that represents five Japanese words. When these words are changed into a roman script, they would begin with the letter "S". Some commonly used words describing the steps in 5S are Sort, Set, Shine, Standardise, and Sustain. Throughout various organisations, a wide range of words is employed to exhibit similar definitions. Regardless of the particular words being employed to determine the steps in 5S, the same objective remains, namely to develop an arranged clean, and systematic work environment. In reality, the principles within 5S were used by Mr Henry Ford decades before. It was reported that prior to 1920, Mr Ford was employing CANDO in his manufacturing processes. The acronym CANDO represents Cleaning up, Arranging, Neatness, Discipline and Ongoing improvement. In the 1950s, the representatives from Toyota paid a visit to the Ford facilities for training in automotive mass production approaches. Following that, the Japanese later adapted the CANDO approaches and applications in their production facilities.

What is 5S

The 5S approach is a standardised process that develops and retains an arranged, clean, secure, and effective workplace upon proper implementation. Enhanced visual controls are applied as a part of 5S to clarify and efficiently detect any non-conformances of a procedure. In most cases, 5S is a factor of a larger Lean initiative and encourages constant enhancement. Following is the list of 5S:

1 Seiri / Sort: Separation of the crucial from the non-crucial items

2 Seiton / Straighten: Arrangement of the crucial materials where all matters have their respective place

3 Seiso / Shine: Cleaning the workplace

4 Seiketsu / Standardise: Developing a system for the development and maintenance of 5S as a habit

5 Shitsuke / Sustain: Developing a secure and sanitary work environment (safety)

The 5S principles are acknowledged in numerous industries as efficient tools for the improvement of workplace organization, reduction of waste, and increased efficiency. It is important for companies to prevent the perception of 5S Principles as the entirety of the organization initiative towards enhancement. In other case, it would be developed into the final objective of an organization enhancement procedure rather than a primary section of a more significant and constant process of enhancement. The strongest advantage of the use of 5S is acknowledged when it is a section of a stronger initiative and the overall company has applied its principles. The 5S is beyond a system, given that it is a business philosophy and should be incorporated into the company culture.

The Reasons for Implementing 5S

Numerous advantages are present in the implementation of 5S methods in a workplace in the production line or business office. To gain survival and success in the current business, cost control is important while waste should be prevented or removed. Upon a proper implementation of the 5S steps, numerous types of waste could be identified and eliminated in any procedures or workstation. An arranged work area leads to decreased excessive motion and waste of time seeking the correct equipment. The visual factor of the 5S Methodology is highly efficacious. In this case, identifying a lost item would be more convenient when all things are placed properly. Furthermore, a clean work area assists in emphasising the probable issues or threats, while a clean floor assists in identifying any spills or leaks that can show machine maintenance and avoid falls and slips. Motivating individuals to seek and solve issues could lead to a favourable change in a company culture. Thus, the 5S Principles are applied as a part of a larger Lean initiative or a standalone tool that could lead to a decrease in waste, increase quality, foster security, and contribute to constant enhancement.

The Methods of Implementing 5S

1. Sort

Sorting is the first stage of 5S, in which the team must undergo the entire subjects in the work area, which include any components, provisions, and bulk storage sections among others. The 5S team leader must assess and conduct an evaluation on each matter with the group, which could assist in identifying the specific matters that are important for successfully fulfilling the job. When the matter is important for daily operations, tagging and cataloguing it would be challenging. However, when the matter is not important,

the frequency of its use in work performance within the region is determined. When the matter is in bulk, the suitable amount to be maintained in the area is decided while the other amounts are transferred to storage. Excess inventory is one type of waste that should be removed during the 5S processes.

2. Straighten

Appoint a site for all matters that are maintained in the work area. Accordingly, a frequently referred to quote is "a site for all matters in place". In the straightened step, the methods of reducing and eliminating waste are sought out. One type of waste in a procedure is the unneeded movement by the operator. Thus, the components and provisions should be kept in the work area near the operator at the moment. The construction of shadow boards for all the necessities is an effective approach that is regularly employed to prevent the waste of time in seeking the correct tool. Meanwhile, matters that do not have frequent use should be kept based on the amount of use. Following that, the entire parts bins should receive proper labels, which comprise the part description, part number, location of storage, and the suggested min/max quantities. A straightened work area enables an evaluation and verification by the operator at a fast rate regarding their capability to effectively fulfil their duty.

3. Shine

The following stage is the cleaning of all items in the region and dirt removal to decrease waste and increase operator security and efficacy. To achieve effectiveness, the cleanliness of the region and any associated tools should be maintained. Dirty process equipment could enhance the potential for process variability, which causes the equipment to be broken. The time wasted following the broken equipment is regarded as waste and non-value-added time.

Furthermore, a region with dirt could also cause safety problems that could possibly lead to injury for the worker. Cleaning of the regions is compulsory for the operators when each shift ends, which allows them to identify issues including oil or lubricant leaks, burnt-out bulbs, worn lift cables, and dirty sensors among others.

4. Standardise

The fourth stage is identified as the most crucial step in the 5S Process. In this process, the standards for the 5S system should be established and employed to measure and maintain the previous 5S stages. Furthermore, this step creates checklists, standard work, work instructions, and other documentation. Without work instructions or standard work, operators have the tendency to perform tasks at their own pace rather than as per instruction by the team. Notably, the practice of visual management holds a high value in this stage, while colour coding and standard colours for the surroundings are applied in some cases. Posting of photos of the region in the standard 5S configuration is frequently made to efficiently determine the non-conformance. In this case, operators receive training for the detection and correction of non-conforming states. Schedules must also be created to regularly conduct maintenance activities in each region.

5. Sustain

Sustaining follows the Sort, Straighten, Shine, and Standardise stages. This step aims to instil the 5S procedure into the organisation culture. The organisation should dedicate an effort to treat 5S as a lifestyle to ensure the maintenance of the advantages obtained through the exercise. However, 5S is not a one-time exercise. In this case, adherence to the 5S Process should be habitual. In some cases, this stage in the 5S Process could pose the most challenges of all the five stages while also holding the highest importance as it highlights

the necessity of performing 5S consistently and systematically. In this step, a standard audit system is commonly established and applied.

Several companies have included safety, which is another stage and named the procedure 5S + 1. This step is included to encourage a culture that improves safety through the identification and removal of any workplace hazards. Additionally, the selection and design of workstations and equipment are made with genuine ergonomics taken into account. In every other 5S step, the motto "safety first" is highlighted.

The Eight Types of Waste:

As per the previous statement, 5S Principles are efficacious components for the reduction of waste, improvement in quality, increase in effectiveness, promotion of safety, and the encouragement for constant enhancement. Upon the application of 5S Methods, the diverse types of waste should be taken into account, which are as follows:

1. Overproduction – The production of excessive products or faster production of components compared to the downstream procedures enable the utilisation. Make an effort for the production of the right amount at the right time.
2. Excessive Inventory – This form occurs from excessive production or negative purchasing practices over the purchase of supplies due to the great deal, which may not be the case occasionally. Uncontrolled or unnecessary inventory could also lead to other types of waste.
3. Inappropriate or Non-Value-Added Processing – Waste accumulates when the wrong equipment is used, unnecessary operations are performed, or the procedures or components for

the job with the highest efficiency are not employed. The phrase "because we have always done it this way" would be taken into account. Besides, the correct procedure and components could lead to waste reduction in your procedure.

4. Waiting – The waste of time and resources takes place upon the wait on sections, information, or supplies.

5. Transportation – Uncontrolled movement or travel of materials is wasteful. A correct process and planning design could assist in the reduction or elimination of excessive transportation. When value stream mapping is used, the team is able to see the extent to which the material travels.

6. Unnecessary Motion – Any change or motion made by the operator that does not lead to the addition of value is a waste. In the 5S exercise, the movement needed to fulfil the task is examined. The workstation is managed to ensure convenient identification of the location of all components and supplies nearby. There are several cases when re-sequencing specific stages of a procedure could decrease the excessive and repetitive movement or motion by the operator. Subsequently, a more ergonomic workstation could be achieved. Overall, safety should be the utmost priority.

7. Defects – This is the most unfavourable type of waste. The production of non-conforming components or gatherings would create more scrap, low process efficiency, waste machine, duration of procedure or gathering, and non-value added tool wear. The deficiencies could also accumulate waste further as waiting duration when usable components are exhausted in the downstream operations.

8. Untapped Employee Creativity (potential) – Currently, numerous organisations have acknowledged their workers as their finest

asset. The origin of new ideas is not predictable by an individual. It is compulsory for organisations to build an environment that encourages the creation of ideas. Several companies with the highest success develop a culture where the workers' ideas are considered and assessed. Upon the implementation of positive ideas, the worker would gain recognition and reward.

Upon the implementation of the 5S programme or other lean tools, caution about a wide range of waste types is necessary. Begin the elimination of waste in your procedures, in which the team members should participate and be motivated to present ideas for enhancements. When collaboration takes place among teams to identify, solve, and remove waste and bring improvement to their workplace, the procedures would be under their possession. Additionally, they have the likeliness to identify the non-conformance in the future. After the 5S Principles are developed into a habit at a gradual rate, a culture of constant enhancement could be achieved.

The Advantages of 5S

Upon correct use, 5S principles are able to lead businesses through the procedures of cleaning and managing the workplace to achieve the highest level of effectiveness, make a reduction of waste, reduce costs, and increase employee dedication. Among the concepts with the highest importance emphasised in the lean manufacturing model is the concept of a decrease in waste. When waste is eliminated, productivity could be increased. Moreover, one will be capable of seeing, thinking, and making clearer and precise movements, which subsequently creates efficiency in business. The removal of extraneous items allows the development of more effective procedures by removing the clutter and increasing the prominence of the important components.

The decrease in cost is another primary advantage of 5S. This factor is in line with the removal of waste, considering one's ability to allocate space and time for more important tools for a business. From a physical viewpoint, it would indicate that paying a significant rental fee is not necessary or one might be capable of reducing the costs related to heating, cleaning, cooling, and maintenance among others. Taking the elimination of clutter into consideration, one will be in a better situation to identify the deficiencies to be solved beforehand. This condition could lead to the reduction of repairs and replacement costs, and remove the possible downtime in operations.

Other benefits to the use of the 5S system are present, which include improvement in workplace safety, which is significant to business owners. A dedication to cleanliness and a decrease in clutter, including standardized procedures, are able to decrease safety hazards to workers and consumers. Subsequently, one would be able to identify the risky actions, decrease the possibility of injury, and enhance the capability of predicting harmful conditions in the workplace. This ability allows a person to conserve cost and time, enhance productivity, and ingrain good faith among the employees.

In the case of enhancing employee morale, the 5S system is an ideal method of accomplishing a more significant objective. Considering that 5S needs every worker to be responsible for maintaining the swift arrangement and flow in the worksite, employee investment could be enhanced. The workers' commitment to their daily duty and organisation overall could be increased, which could significantly benefit their workplace culture. This condition could create a balance in the costs related to turnover and unavailability of workers. Besides, a happy employee is fundamentally a loyal employee, which benefits both businesses and employees.

In conclusion, in developing a manufacturing business into a leader in one's industry, lean manufacturing principles enable the improvement in operations. Employees with a commitment to the ideas highlighted in the 5S system lead to a notable impact on the achievement of organizations that are dedicated to a streamlined company.

3. Zero Deficiencies in Lean Manufacturing

The quality improvement is an important factor in success in any establishment, particularly in manufacturing companies. An approach to increasing quality is the employment of the philosophy of "Zero Defects", which was initiated by American businessman, Philip Crosby, in his "14 Step Quality Improvement Process". This belief is a mentality or motion, considering that it does not involve any defined category of procedures or regulations to be followed. Zero defects aim towards the minimisation of the amount of deficiencies in as many manufactured services and products as possible and depend on every organisation to adjust their respective regulations. This condition increases the difficulty in the definition of zero defects compared to other set processes while increasing its effectiveness due to its adaptability to any establishments, situations, and industries.

The beliefs of zero deficiencies are as follows:

I. Quality is described as adherence to the specifications

Each service or product must come with conditions (an explanation regarding the matter that customers wish to see). Quality is achieved through a product upon its fulfilment of the specifications. Given that individual products would present their respective criteria to be fulfilled, various product standards are available in diverse products. However, every product should fulfil ITS criteria to gain zero deficiencies.

II. Preventing the deficiencies is more ideal than examining and rectifying the quality.

It is more ideal to identify and mitigate the deficiency in the procedure instead of identifying the deficiency in the finished products. If you spend time and money fixing the process instead of inspecting products for defects, it is time and money well spent.

III. The quality standard indicates the absence of deficiencies

Essentially, any product that does not fulfil the conditions specified for that product would not be acceptable for the customer and does not cover what is needed by the customer. In the case of a product that fulfils the need while not meeting all the conditions, review and changes should be made on the conditions to be in line with reality.

IV. Measurement of quality is made in the form of money (e.g., the price of non-conformance: PONC)

This belief makes an assumption that each deficiency denotes a hidden cost: rework, inspection time, revenue, material waste, customer disappointment, and labour. Upon proper identification, the measurement could be made on the costs, which could justify the expenditure on the stages towards quality improvement. This condition offers a monetary method of measuring the Zero Defect Management Process, which is a solid and important method of maintaining management dedication to fulfilling the organisation objectives. Accordingly, Zero Defects is an effectual belief for Quality Management, in which a person would establish their respective regulations and standards. However, it would develop into an efficacious Lean Manufacturing tool when adhered to.

4. Six Sigma

Six Sigma is an approach employed to increase the quality of production output in general. Initially established by Motorola, the six sigma process is employed for the removal of the factors leading to variation and deficiencies in manufactured products. It is also extensively acknowledged as a crucial concept of Lean Manufacturing.

In terms of function, Six Sigma depends on some other quality management procedures, which include statistical approaches (e.g., tables, charts, and data collection). Upon the implementation of Six Sigma in organisations, projects include a defined order of stages and quantified targets in general, which could be production procedure, product quality, the quantity of other set objectives, or financial conditions. The objective is to achieve as many "zero defects" as possible. Provided that a company is able to make measurement of "defects" in a procedure, systematic identification of the methods of reducing or removing the deficiencies is possible.

In the quality management world, "Six Sigma Quality" is described as a procedure that creates deficiencies that amount to a maximum of 3.4 for every million opportunities. Meanwhile, an "opportunity" could be described as the possibility of the procedures or products to not adhere to the requirements, which indicates that six sigma quality management requires a procedure to be conducted close to perfection.

Methodologies

Six Sigma projects may be based on two distinct methodologies with five stages: DMAIC and DMADV. Specifically, DMAIC is employed primarily for projects that aim to improve the existing manufacturing procedures, while DMADV is employed mainly for projects that aim to create a new product or process designs.

1. DMAIC

Define – Present definition of the issue based on customers and process viewpoint

Measure – Conduct measurement on the existing procedure and collection of valid data

Analyse – Conduct an analysis of the gathered data to identify the association with the issue and the methods of solving

Improve – Make improvements to the overall procedure following the analysis of the gathered data

Control – Manage the next steps of the procedure to avoid any divergence from the target

2. DMADV

Define – Present the definition of the objective to fulfil the customers' demands and the manufacturing procedure

Measure – Determine the production process ability, risks, and product abilities

Analyse – Following the creation of the design, analysis is conducted to identify which is ideal to be implemented

Design – Enhance the selected design while arranging for the following step, in which the use of software or prototype is required in simulations

Verify – Make verification of the design by setting up pilot runs, implementing the production procedure, and delivering it to the procedure owners

Importance of Quality Management

Quality management definition is the process of managing all activities, personnel, and work tasks that are needed to achieve

and maintain a certain level of quality and excellence. Quality management encompasses all aspects of the organization including creating quality-based policies, developing quality planning measures, conducting quality control, and constantly striving for quality improvement overall.

What is QMS? QMS stands for quality management systems, the definition of which is the totality of organizational processes that are focused on producing an output that meets defined specifications. Quality management systems can be 'home-grown', meaning they are developed and designed completely within an organization, or they can be adaptations of existing quality management models or frameworks. Quality management systems help coordinate all organizational activities to meet their desired levels of excellence on a continuous basis.

"Quality management" ensures superior quality products and services. Quality of a product can be measured in terms of performance, reliability and durability. Quality is a crucial parameter which differentiates an organization from its competitors.

Quality management tools ensure changes in the systems and processes which eventually result in superior quality products and services. Quality management methods such as Total Quality management or Six Sigma have a common goal - to deliver a high quality product.

Quality management is essential to create superior quality products which not only meet but also exceed customer satisfaction. Customers need to be satisfied with your brand.

Business marketers are successful only when they emphasize on quality rather than quantity. Quality products ensure that you survive the cut throat competition with a smile.

Quality management is essential for customer satisfaction which eventually leads to customer loyalty. How do you think businesses run? Do businesses thrive only on new customers? It is important for every business to have some loyal customers. You need to have some customers who would come back to your organization no matter what.

Would you buy a Nokia mobile again if the previous handset was defective? The answer is NO.

Customers would return to your organization only if they are satisfied with your products and services. Make sure the end-user is happy with your product. Remember, a customer would be happy and satisfied only when your product meets his expectations and fulfills his needs. Understand what the customer expects from you? Find out what actually his need is? Collect relevant data which would give you more insight into customer's needs and demands.

Customer feedbacks should be collected on a regular basis and carefully monitored. Quality management ensures high quality products and services by eliminating defects and incorporating continuous changes and improvements in the system. High quality products in turn lead to loyal and satisfied customers who bring ten new customers along with them. Do not forget that you might save some money by ignoring quality management processes but ultimately lose out on your major customers, thus incurring huge losses.

Quality management ensures that you deliver products as per promises made to the customers through various modes of promotions. Quality management tools help an organization to design and create a product which the customer actually wants and desires.

Quality Management ensures increased revenues and higher productivity for the organization. Remember, if an organization is earning, employees are also earning. Employees are frustrated only when their salaries or other payments are not released on time. Yes, money is a strong motivating factor. Would you feel like working if your organization does not give you salary on time? Ask yourself. Salaries are released on time only when there is free cash flow.

Implementing Quality management tools ensure high customer loyalty, thus better business, increased cash flow, satisfied employees, healthy workplace and so on. Quality management processes make the organization a better place to work.

Remove unnecessary processes which merely waste employee's time and do not contribute much to the organization's productivity. Quality management enables employees to deliver more work in less time.

Quality management helps organizations to reduce waste and inventory. It enables employees to work closely with suppliers and incorporate "Just in Time" Philosophy. Quality management ensures close coordination between employees of an organization. It inculcates a strong feeling of team work in the employees.

Total Quality Management

Total Quality Management (TQM) is an approach to systematically improving quality using many dimensions and has been widely applied by many companies with the aim of improving performance such as quality, productivity and profitability. In various operations management literature, it is known that companies throughout the world have implemented TQM for the last few decades. Besides that, there has been a lot of research conducted by experts who focus on the TQM concept by using or reviewing it from various different areas or contexts.

Since the early 1980s, TQM has received great attention from managers, because it has been proven to be able to improve company performance. Total Quality Management (TQM) is a new paradigm in running a business that seeks to maximize organizational competitiveness through a focus on customer satisfaction, involvement of all employees, and continuous improvement of the quality of products, services, people, processes and the organizational environment (Krajewski and Ritzman, 2006).

TQM is an approach that today's organizations should take to improve product quality, reduce production costs and increase productivity. Implementation of TQM also has a positive impact on production costs and income (Gaspersz, 2005). Other evidence also shows that companies that pursue TQM best practices can achieve higher profits and cash flows as well as greater shareholder value (Corbett and Rastrick, 2000). According to Sila et al. (2007) total quality management (TQM) plays a very important role in increasing a company's competitive strength. In a global market that changes continuously, besides fast delivery (speed of delivery), product quality is also an important element for companies to be able to compete (competition). TQM is a form of best management practice in companies that emphasizes the overall quality paradigm in the company.

Theoretically, quality is the totality of forms and characteristics of goods or services that demonstrate their ability to satisfy obvious or hidden needs (Chase et al., 2005). Several quality experts define quality with various interpretations. Juran (1989), defines quality simply as 'fitness for use. This definition includes product features that meet consumer needs and are free from deficiencies. Factually, quality is a concept that is quite difficult to understand and agree on. Nowadays the word quality has various interpretations, cannot be defined singularly, and is very dependent on the context.

Heizer and Render (2004) argue that quality mainly affects companies in four ways, namely: (1) costs and market share: improved quality can lead to increased market share and cost savings, both of which can also affect profitability; (2) company reputation: the company's reputation follows the reputation of the quality produced. Quality will emerge along with perceptions about a company's new products, employee handling practices, and its relationships with suppliers; (3) product liability: the organization has great responsibility for all consequences of the use of goods and services; and (4) international implications: in the technological era, quality is the focus of attention in the operational field. If the product produced is of high quality, it will have implications for increasing demand for the product in the international market.

Quality has become an important aspect of competition in the global market. Every company can improve its performance through continuous improvements in consumer-focused business activities, namely covering the entire organization and emphasizing flexibility and quality. Therefore, quality and management are always linked to continuous improvement activities in order to win the competition.

Performance measurement is the most important activity for management in managing a company organization. In general, performance is defined as the extent to which an operation meets performance objectives, and key steps in order to meet customer needs. The facts show that without measuring performance, it is difficult to improve it. Therefore, improving organizational performance requires identifying the variables that influence it and measuring them accurately. Performance measurement is very important for an organization, so that optimal business performance can be achieved (Demirbag et al. 2006).

Brah and Lim (2006) say that company performance can be measured in two performance dimensions, namely: operational performance and organizational performance. Operational performance reflects the performance of the company's internal operations in terms of cost and waste reduction, improving product quality, developing new products, improving delivery performance, and increasing productivity. These indicators and variables are considered key factors because they follow directly from the actions taken in the company's operational activities. Meanwhile, organizational performance is measured by financial measures such as revenue growth, net profit, profit-to-revenue ratio and return on assets, and non-financial measures such as investment in R&D, and the company's capacity to develop a competitive profile.

According to Zehir and Esin (2009), business performance measurement can be done through 2 dimensions, namely: innovation performance and employee performance. Innovation performance is measured through product innovation compared to competitors in the market, the number of new products marketed in the last 5 years, and the speed of introducing new products/services on the market. Meanwhile, employee performance is measured through 3 indicators, namely employee satisfaction level, attendance level and employee morale.

Total Quality Management (TQM) is a concept and approach that emphasizes improving the quality of products, services and human resources which is carried out continuously with an effort to reduce waste in the production process which occurs due to errors or less than optimal quality of goods or services provided. produced so that customer satisfaction can be achieved (Yuwono, 2017).

Total Quality Management (TQM), according to Ishikawa in Yanti (2017), is defined as a combination of all company functions

into a holistic philosophy built on the concepts of quality, teamwork, productivity, and customer understanding and satisfaction. Meanwhile Zainal, Veithzal Rivai, et al. (2014) in Pristiyono (2019) said the definition of Total Quality Management (TQM) is a concept that requires commitment and involvement from management and all company managers to consistently fulfill customer desires or satisfaction. The indicators that measure job characteristics in this research are as follows:

1) Focus on customers
2) Continuous improvement
3) Education and training
4) Employee involvement and empowerment.

Basically, Quality Management or Integrated Quality Management (Total Quality Management = TQM) is defined as a way of continuously improving performance (continuously performance improvement) at every level of operation or process, in every functional area of an organization, using all available human and capital resources (Vincent Gaspersz, 2011:9). Quality Vocabulary (ISO 9000:2005) defines quality management as all activities of the overall management function that determine quality policies, objectives and responsibilities, and implement them through tools such as quality planning, quality control), quality assurance and quality improvement. Although quality management can be defined in various versions, basically quality management focuses on continuous improvement to meet customer satisfaction.

Total Quality Management is a concept that seeks to implement a world-class quality management system. This requires a large company in the culture and value system of an organization.

According to Hensler and Brunell in Nasution (2010:30), there are four main principles in Total Quality Management. These four principles are:

1) Customer Satisfaction The needs of internal customers and external customers must always be satisfied, both in terms of product, service, price, safety and timeliness. Customer satisfaction will occur if the service provided is in accordance with what the customer expects, but what often happens is the gap between the two, making it difficult for customers to feel satisfied. A product produced can only be said to be of quality if it meets the customer's wishes, thus the product must be produced and the service must be provided in accordance with the customer's needs and desires. By being oriented towards customer satisfaction, the company will improve its performance and improve the quality of its products and services continuously and respond quickly to the ever-changing desires of customers.
2) Respect for Everyone Every person in the company must be seen as the most valuable resource because they have their own unique talents, therefore they must be treated well and given the opportunity to be seen and participate in the decision-making team. Sometimes companies only carry out repairs and maintenance on products and forget about the existence of employees as the main key to success. Building good relationships within the company will make employees feel trusted and dependable, thus encouraging them to create new ideas and creativity which will in turn increase productivity and improve the quality of services provided to the community while still instilling an attitude of mutual respect.
3) Management based on facts. Every decision made within the company must be based on facts that occur in the field, which

have been confirmed to be true, not just based on feelings and experience. Change always occurs continuously, so companies must continue to keep up with the times. By looking at the facts that have been collected and processed into data, the accurate condition of the company can be known, so that management can predict the results of every decision and action taken correctly. With this data, companies can find out the parts that need improvement, so that improvements can be made to the parts that need it most first, because improvements cannot be made to all aspects at the same time due to limited resources. The improvements made by the company will ultimately be able to improve the quality of products and services provided to the community.

4) Continuous Improvement Every company needs to make continuous improvements to achieve success. In continuous improvement, a product is said to fail if it deviates from customer expectations. To carry out continuous improvement, it is not only necessary to increase resources, but also to improve systems. In solving problems, companies must look for the source/cause of the problem and the solution to the problem at the same time, not just emphasize one of them. The most important thing in continuous improvement is communication, so that each department knows its job description and reports progress and setbacks to each other, as well as continuing to monitor changes. By carrying out continuous improvements, it will have an impact on improving the quality of the company's products and services.

Total Quality Management is a system that can be developed into an approach in efforts to maximize organizational competitiveness through continuous improvement of production, services, workforce and processes. The management accounting system used in this

research includes a performance measurement system. Measuring employee performance can improve quality. From a learning perspective, the frequency of reporting production performance measurements will help employees develop strategic work effectiveness quickly and improve their performance. Increasing employee performance productivity will of course be very beneficial for the company.

Implementing Total Quality Management requires fundamental changes in organizational infrastructure, including authority allocation systems, decision making, performance measurement systems, reward and punishment systems. Implementation of Total Quality Management techniques must be followed by implementing a reward system in parts of work that improve quality so that it can be useful as a means of career development and increase the effectiveness of strategic work quickly and can improve the performance of managers and employees.

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The concept of quality is a modern pursuit for excellence among managers, serving to attract customers and achieve market leadership. Its roots can be traced back to earlier times, notably seen in Japanese craftsmanship and acknowledged in Islam. Quality, defined by the European Organization for Quality Control, encompasses various attributes that meet customer needs, although its interpretation varies widely. Stakeholders perceive and define quality differently, impacting areas such as employee performance and customer satisfaction. Collaboration among stakeholders is crucial for maintaining high-quality standards. Finally, the book "Quality Management and Tools" is more than a manual for success; it symbolizes human ingenuity and the relentless pursuit of excellence, serving as inspiration for future innovators and leaders.

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