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1.1 Conceptualization of notion of quality in evolution approach

The Quality: The science of quality is considered, at the present time, one of the essential sciences that improve and promote the building of companies and goal setting, and the foundation for implementing these goals in all that aligns with the strategy of the companies and the direction of their development. Quality is the most important challenge facing companies and organizations of all kinds. It also constitutes one of the indices to evaluate companies by measuring their current situation and their future among other companies.

The concept of quality has become the main element in evaluating companies and organizations; there for it is very important to implement quality in order to maintain their performance and, of course, for constant improving of production and performance. Later on, I will detail the meaning of the concept of quality, the history of the development of this science, and how it became the main element in evaluating companies and organizations. [2, p. 9]

Infinite books and infinite articles have been written which attempt to define, explain and illustrate these subjects. An Israeli CEO of a construction company or a public organization, who is genuinely interested in improving the performance of his company or organization, will often encounter vague wording, unclear and rather general definitions, and examples that are not necessarily similar to what is happening in his company or organization. To that, one can add a variety of management methods and concepts linked to the subject of quality. Many of those, as if to sow more confusion and embarrassment, have "bombarding" initials and names [2, p. 8]:

VE - Value Engineering
TPQM - Total Productivity & Quality Management
QC - Quality Control
QA - Quality Assurance

TOC - Theory of Constraints

JIT - Just In Time

TQM - Total Quality Management

Eventually, the CEO will not always find answers to simple questions of a practical man:

* What should I do to establish a quality system?

* Where should I start?

The History of the Beginning of Quality: The history of quality began in 17th century Europe, when various professionals began organizing unions in Europe, which they called organizations, until the 19th century. Production in the industrialized world tended to follow this professional model. Factories began focusing on product testing in Great Britain in mid-1750. It then developed until it took shape in the form of the industrial revolution in the early 1800's.

Early in the 20th century, craftsmen began establishing a quality process in factories. During the involvement of the United States in World War II, there was more pronounced need for quality, especially in terms of manufacturing for war purposes: for example, bullets manufactured in the U.S. needed to be suited for guns manufactured in different districts. And here began the process of production testing only for the need of simplifying this process regardless of safety.

Thus the army began to sample certain products and work on their suitability, until indices and military specifications were announced, thus began the process of perfecting in terms of testing and the manner of sampling, as well as supervision of production. However, upon World War II, a large number of U.S. factories began production for war in order to supply equipment and weapons for war, which affected local civil production till the point of shortage of civilian products such as refrigerators, stoves, etc.

This change caused factory owners and businessmen to ask workers and engineers to increase production at all costs, even at the expense of product quality. This, of course,

led to a significant decrease in the product quality.

After the war, Dr. Edward Deming and Joseph Juran wished to focus on quality rather than quantity. They founded groups and published guidelines for improving quality but their requests were not answered.

Japan, who was destroyed from the war and whose goal was to restore industrial and economic building and development, invited Edward Deming and the engineer Joseph Juran to give a number of lectures in front of businessmen, industrial personnel, engineers and workers, as well as in Japanese universities.

Quality theory echoed and was accepted very well in Japan. The Japanese industry sought to implement this theory in all factories, until its implementation became serious throughout Japan, and all products were required to be subjected to rigorous testing for detecting industrial deficiency during production.

This process resulted in a significant improvement of the Japanese industry and Japanese products on a world-scale. No product was marketed without rigorous testing for product quality. This caused the Japanese industry and products to be received excellently in the markets, even in the U.S. itself. This industry was favorable in the eyes of consumers - products without defects. Thus the Japanese industry developed and production increased, to a point where Japanese products jumped from 4% to 20% of consumption in the U.S. in just a small number of years, and to a larger percentage in the years that followed. Products in the United States were not marketed and remained in factories without any buyers. During this period, there was no full understanding of what was happening in the U.S. First they tied this phenomenon to the low prices of Japanese products, and therefore lowered the prices of products at the expense of quality. Japanese products dominated again in the U.S. markets and took over the U.S.

After years of frustration, Americans came to the conclusion and began to apply quality theory and to test every product using rigorous testing similar to the ones of Japan, but these tests added additional costs. They got used to production in poor quality, and as a

result, several factories crashed again.

Then there was a need for a thorough analysis of what happened, and a view of the entire production process, as the situation was intolerable. They came to the conclusion that it is necessary to test the product during production and not post-production. Indeed that was a success, but it was too late; they failed to produce a single product in better quality than the quality of Japan.

Then Americans found the Japanese secret of the concept of "total quality", which the Japanese developed before them, after the implementation of the quality process (which belonged originally to the Americans). This step handles the product throughout its life at each and every stage, and repairs the defect before proceeding to the next step.

In the early seventies, industries in the U.S. developed, especially the industry of vehicles and electronic products, because of Japanese competition of high quality products, on the basis of Total Quality Management (TQM).

“Management is concerned with producing order and consistency through actions such as planning. budgeting, organizing and controlling. while leadership is concerned with producing and movement by vision building. motivating, aligning people and communicating. This is not to imply that leadership is “good” and management “bad” to recognise that they serve different purposes and require different skills. management serves us well in static situations (one might think of the situation of ford in early 20th century) however, more dynamic situation require leadership.

Traditional organization have tended to emphasise control and organization (management) over vision and motivation (leadership).

This result in static organizations good at doing what they have always done, and focused on ensuring management instructions are carried out, but poor at responding to changing environments and developing situations which are increasingly the norm in the modern business environment". [4. p. 11]

Defining Quality: In daily usage, quality contracts with luxury, because, in the past, obtaining a product with good features that lasted for a long time involved a high price. The question arises: Is the product cost not part of its features?

Even-Shusan Dictionary defines *quality* as: "nature, attribute, value, inner essence of a thing" and the concept *qualitative* as: "that constitutes the nature and attributes of one thing." These definitions, which extract the concept of luxury from the word quality, connect well with the professional definitions of the word quality.

The professional definitions of quality are numerous and varied:

- Feigenbaum defines quality as "the total composite product and service characteristics of marketing, engineering, manufacturing and maintenance through which the product and service in use will meet the expectations of the customer" [35, p. 925].
- Juran defines quality as "fitness for use or purpose, regardless of product condition" claiming that in this definition he takes into account two more definitions of quality, which are "product features" and "freedom from deficiencies" (36, p. 8].
- Deming defines quality as "predictable degree of uniformity and dependability at low cost with a quality suited to the market" [39, p. 27].
- Taguchi defines quality by defining its opposite. According to Taguchi, non-quality is "the loss imparted to society from the time the product is shipped" [39, p. 27]. Taguchi is aiming at the costs of non-quality, and what he means is that the more the product is of higher quality, the smaller the loss of society as a result of

the costs of non-quality. Taguchi refers to the test of society and not to the test of a company. Later we will see that this broad reference to the topic of quality is common to all experts on the subject.

- The American Federal Quality Institute defines as follows: "performing the right job correctly from the first time, relying on assessment learned by knowledge throughout the performance improvement"
- Armand Feigenbaum's definition: "customer satisfaction".
- Crosby, 1979: "conformance to requirements. The more compatible product features are to customer requirements, the more this product is of good quality".
- International Standard ISO-9000: 2005 "the degree to which a set of inherent characteristics of a product fulfill customer requirements", [14, p. 32].
- Omer and Sefy Akili: "the production of a product by an organization, or presenting a service of high quality that can satisfy the needs and requirements of the customers in a manner that aligns with their expectations and gaining their favor and joy, and this is implemented by predetermined measurements in the production process of the product or the service and finding a unique feature", [14, p. 22].

The accepted and simplest definition of quality is: "satisfying customer needs" or "meeting customer requirement" [39, p. 453].

Standard ISO-8042 and Israeli Standard 1432 define quality as "the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs". This definition is used by Standard ISO-9000, as well as by the Israeli Standard 9000.

The Quality Triangle: One can express the manner of reference to quality as part of the forces working to create a product, using the model described in Figure 1 [47, p. 207]. This model, often called "triangle quality", explains that in addition to the minimum cost and minimum time, we must strive for maximum quality when manufacturing a product. Also, the model emphasizes that a product cannot be defined in terms of cost and time

only and regardless of its quality.

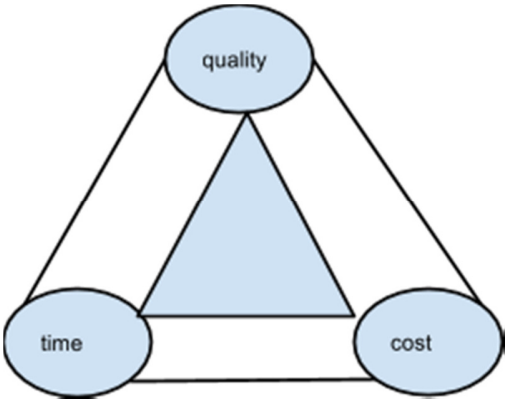

Fig. 1 - The Force Triangle - Quality, Cost, Time [47. p. 207]

Another possible model, which better matches the various definitions of quality, and which explains the role of quality as part of the forces working to create a product is depicted in Figure 2. This model explains that quality means durability of costs, schedules and fulfillment of all other product features (all according to customer needs). [47. p. 207]

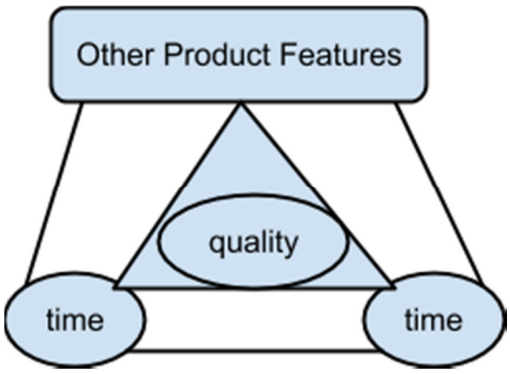

Fig. 2 – The Quality Triangle [47. p. 207]

The difference between the two models above also explains, in part, the development of the concept of quality in the different approaches. Quality turns from being another characteristic of the product to the source of its definition. [47. p. 207]

The Evolution of Quality Management: The evolution of quality management in the years that followed the Second World War was not significant, but was steady and stable and stood out after a number of studies from the last century.

But later on, this science developed in several stages, and each stage has not canceled the one previous to it, but contained it and developed it as explained below:

Testing Stage: In this stage, which was the initial stage, they would test the suitability of the product in accordance with ISO-9000: 2005. The test was visual and done by measuring and observation, and in accordance to the research of Taylor, who strive to improve production output in the factory by separating the defective products from the proper products. He found that about 15% of the products were defective, and tried to fix these products and ensure that they will not be marketed with the proper products. The defect had already been made, and the test discovered it. The test did not, however, observe why this had happened.

Quality Control Stage: in conformity with ISO-9000: 2005, is "a part of quality management that focused on the requirements of quality". This means planning for testing from the beginning of the production or service, through the use of modern statistical methods for quality supervision. This contributed to the discovery of errors and defects at an early stage, but it was not possible to prevent the flaw and predict it. We can say that all quality control is considered a more developed stage of testing in terms of the complexity of the methods and the developing of the procedures used.

Quality Assurance Stage: Quality assurance stage has been defined in accordance with ISO-9000: 2005 as a "part of quality management which concentrates on providing security that quality is achievable". This stage focuses on directing all efforts at all management levels to participate in the design and quality supervision, to prevent a

defect or error. This stage prevents the defect from happening right from the start, and focuses on the requirements of the customer who became the target of organization and factory occupation, and creates the easement of product definition, and prevention of errors at the initial stage, which increases quality assurance for the customer. [10. p. 22]

Quality Management Stage: The stage of quality management is an inclusive stage of product manufacturing which includes all employees and aims to continually improve the quality and long term performance. Thus can the organization implement quality management to achieve maximal achievements, and by that, ensuring that customer requirements are implemented. In this method, the organization or company can implement its goals.

Fig. 3 - Quality development stages [2, p. 11-15]

Costs of Quality Management: The concept was weaved by Feigenbaum in the 40s. Since then, and to the present day, the components of these costs have not changed. [35, p. 925], eigenbaum divides quality costs to "Costs of Quality Control" and "Costs of Quality Control Failure" [35, p. 925], Feigenbaum uses the word "control" in the broadest sense and his intention is actually to all quality activities. When saying "Quality Control", he actually refers to the quality system. Therefore we shall use the terms "Costs of Quality System" and "Costs of Quality System Failure" instead of "Costs of Quality Control" and "Costs of Quality Control Failure". Some call "Quality Costs" by the name "Costs of Non-Quality", because those are costs which quantify the non-quality in the system and not the other way around. [9.p. 85]

Costs of quality system are Prevention Costs and Appraisal Costs of a quality system. Costs of quality system failure are Internal Failure Costs and External Failure Costs.

Prevention costs include the costs of writing, maintaining and updating of specification procedures and standards, the costs of preparing a quality plan, the costs of training and qualification of employees, the costs of purchase quality, the costs of quality circles and so on. Appraisal costs include the costs of inspection, the costs of entry control, the costs of process inspection and final inspection, the costs of calibration and maintenance of the means of measurement, the costs of external inspection and so on.

Internal failure costs include the costs of disqualification of materials and products, the costs of excess inventory holding, the costs of changing the type of quality, the costs of rework and repairs, the costs of investigations of mismatches, the costs of change as a result of mismatching and so on. External failure costs include the costs of product revocation, the costs of rework and repairs, handling customer complaints, the costs of rejecting a product or service, the costs of service during warranty, the costs of marketing errors, the costs of damages as a result of suppliers and so on.

In defining costs, Feigenbaum was careful not to include costs that could generate objections from organizations he advised or worked at. Therefore, there are costs that are a waste and not included in the list of Feigenbaum that can certainly be placed under the heading of quality costs. For example, costs due to delays and waiting, costs due to low efficiency, costs due to hasty investments and costs due to rejection of personnel. [9. p. 102]

Developments in Regard to Quality Costs: It has been related to quality system costs and failure costs for a long time by finding the balance between both, as shown in Figure 4 [36, p. 112]. To save costs, according to this approach, one must produce products in such a quality that the total costs of the quality system and quality system failure will be minimal.

In a later period of time, when the standard of living began to improve, it was found that customers were willing to pay more to get higher quality. It follows that the quality of the product should be determined according to the maximal financial gain that can be derived

from it, that is shown in Figure 4.

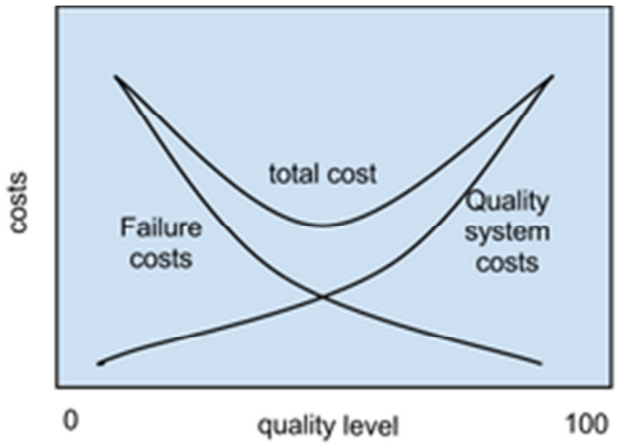

Fig 4 - Quality Cost - The Maximum Profit approach [36, p. 112]

The significant change in the attitude to the subject of quality occurred when Japanese companies were able to provide a quality equal to the quality of American and European companies, but at a cheaper price. This was especially evident in the automotive and electronics industry. They were basically able to move the graph of quality system costs and cause the preference for their products by customers, as described in Figure 5 [36, p. 112]. This means that it is preferable to produce products of the highest quality.

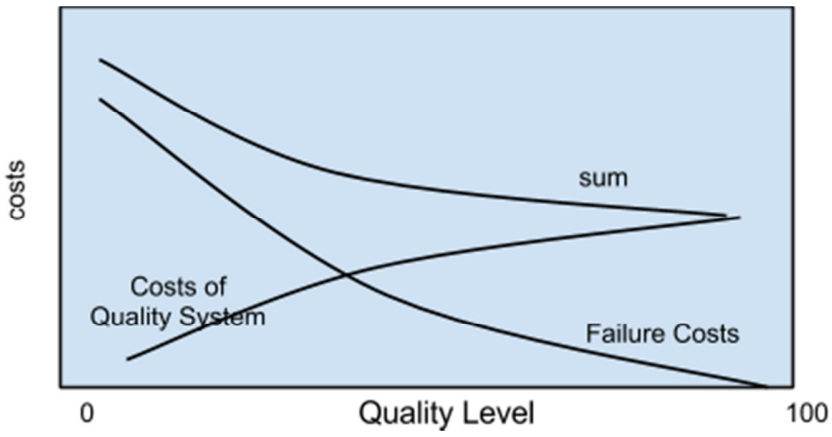

Fig 5 - Quality Cost - The Maximum Quality approach [8. p. 36]

The Project Management Context- Characteristics of the Project Life Cycle

The project life cycle serves to define the beginning and the end of a project. for example,

when an organization identifies an opportunity to which it would like to respond, it will ofen authorize a needs assessment and /or a feasibility study to decide if it should undertake a project. The project life-cycle definition will determine whether the feasibility study is treated as the first project phase or as a separate, standalone project. [2, p. 12].

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