Title: Total Quality Management Practices in the Automotive Industry

Course:
Year: 1993
Author(s): M. Ayabakan

Report No: P93028

Abstract: This project analyzed TQM tools utilized in the automotive industry, and identified the commonly used methods of "continuous improvement" by the leaders of the automotive industry. The study was designed to present the real-world implementations of TQM philosophy in the automotive industry and the results of adopting continuous improvement in their processes.

PORTLAND STATE UNIVERSITY
Spring 1993

EMGT 510

TOTAL QUALITY MANAGEMENT II

TERM PAPER

TOTAL QUALITY MANAGEMENT PRACTICES IN THE AUTOMOTIVE INDUSTRY

Submitted to:

Dr. Richard F. Deckro

Submitted by:

Murat Ayabakan

ABSTRACT

The main purpose of this paper is to analyze the Total Quality Management (TQM) tools utilized in the automotive industry, and identify the commonly used methods in the accomplishment of "the continuous improvement" by the leaders of the automotive industry. The reason for choosing this particular industry can be expressed as the high level of competition the automobile manufacturers are facing globally. This study is aimed to present a report on the real-world implementations of TQM philosophy in the automotive industry, and the results of adopting continuous improvement in their processes.

1.1. INTRODUCTION

As the world became a borderless arena, manufacturers started searching for new approaches to be able to survive in this highly competitive environment. Especially after 1970s, severe competitive pressures coming from foreign manufacturers made the issues such as "quality" and "low-cost production" popular in the manufacturing area. In U.S.A. and Europe, automobile industry appeared to be one of the first among these industries, feeling the threats of foreign auto manufacturers, primarily the Japanese. What was the reason for the Japanese manufacturer's becoming a threat for the high-tech, innovative western manufacturers? The answer to this question was tied, so many times, to their being "low-cost" producers; to their culture, their resemblance to "ants"; working and working, but doing nothing else; to their being "imitators" but not "innovators." However, these constituted only the downside of the main reason which in fact is their "commitment to continuous improvement", that they adopted as their philosophy

in every aspect in the industry, such as; improvement of their processes; improvement of their designs; improvement of their skills. The continuous improvement concept shows itself as the customer preference where the customer purchases the better quality product instead of the other products or services as a result of his/her perception of the product or service. "Fit to the needs" is the key factor in the generation of the perception, meaning that; the customer obviously chooses the product or service which satisfies his/her needs at most. Thus, commitment of the manufacturer to continuous improvement gets to the stage because commitment to the philosophy enables the producer determine what the needs of the customer are and take action accordingly; improving and reshaping its capabilities, procedures and strategies regarding the concerns of the customer.

This paper focuses on the actions taken in the automobile industry which constitutes a good example for examining various practices in achieving the struggle to deliver the best value to the customer due to the competition, intensifying globally. Before getting into the analysis of the practices, it is considered to be beneficial to describe briefly; the need for continuous improvement, which provides the basis for Total Quality Management (TQM) philosophy; and the interrelationship between quality and productivity.

1.2. NEED FOR CONTINUOUS IMPROVEMENT

As Winchell [13, page:4] points out, quality is a competitive advantage in the market place. This means that; a company must deliver, at least the same but

definitely a better quality to its products or services, when compared to its competitors. However, due to intense global competition, competitors fighting in the arena embrace the only strategy which provides them the competitive advantage in the market; continuous improvement. This situation keeps a company improving quality continuously to remain a viable force in the marketplace. Otherwise a gap occurs in the quality of the products or services between the competitors, which ends up creating a substantial competitive advantage to the quality leader. Too great a gap [13, pp.4-5] could result in the quality follower losing a market share or going out of business. Winchell emphasizes that [13, page:6] , once a gap in quality is recognized by the customers, it will take a long time for the quality follower to regain needed confidences in the marketplace. As it is stated by Winchell [13], the situation that U.S. automotive industry faced in the 1980s is a good example for this issue. While the domestic models suffered from marginal drivability and an increasing frequency of repairs during the warranty period, Japanese imports had as little as 25% of the problems during warranty and drove better [13]. Situation turn out to be the battle for survival as the largest domestic producer of vehicles stopped producing small cars in the United States,relying on imports for that market segment.

The result was the plummeted market share of U.S. auto manufacturers from 44% to 36% in less than ten years, in the domestic market. This nose-dive in market share occurred in spite of a formidable quality improvement program throughout the decade and the program helped gradually close the gap in quality. At the end of decade there was almost no difference in quality between domestic and imported cars

but market share was still not regained.

As it can be noticed from the U.S. automobile industry example, once customer perceptions about inferior quality are formed, they are hard to change. Winchell [13, page:5] presents the Gallup Poll results of 1988, sponsored by American Society for Quality Control, which indicates that the perception of quality of American products didn't change in three years, although the repair records of these products indicate dramatic improvement. This gives a good example for how long it takes for a customer to change the perception about quality.

The message of the customer is clear enough; quality comes first. As a result, companies can no longer tolerate adverse gaps in product quality between their products and those of their competitors. To prevent this, a viable program of continuous improvement must be developed and put into practice.

1.3. RELATIONSHIP BETWEEN QUALITY AND PRODUCTIVITY

The undisputable direct relationship between quality and productivity did not take long for the manufacturers to recognize, as they witnessed that better quality producers also enjoyed the increased productivity in their organizations, in addition to their increased market shares. Although in the past productivity gains resulted from better technology as Winchell mentions [13, page:5], lately, there is an increasing awareness that up to 80% of the gains of technology may be possible just through better attention to business basics. This is at the heart of any continuous

improvement effort.

If the relationship between productivity and quality is expressed quantitatively, Winchell's approach [13, page:6] seems to be usable. The author defines productivity as the value of the output of a company divided by the value of the input to produce that output. Revenue can be used as the value of the output, whereas cost may be used as the value of the output. In addition, quality, for simplicity, can be defined as the cost of product failures divided by revenue. Failures could be within the plant and include such things as rework, scrap, reinspection and sorting. Other failures occur after shipping to the customer and may be due to warranty claims, customer complaint, handling and field service. As it is illustrated in Figure 1, productivity can be improved through making quality better. If failures could be eliminated, cost would decrease by 25%.

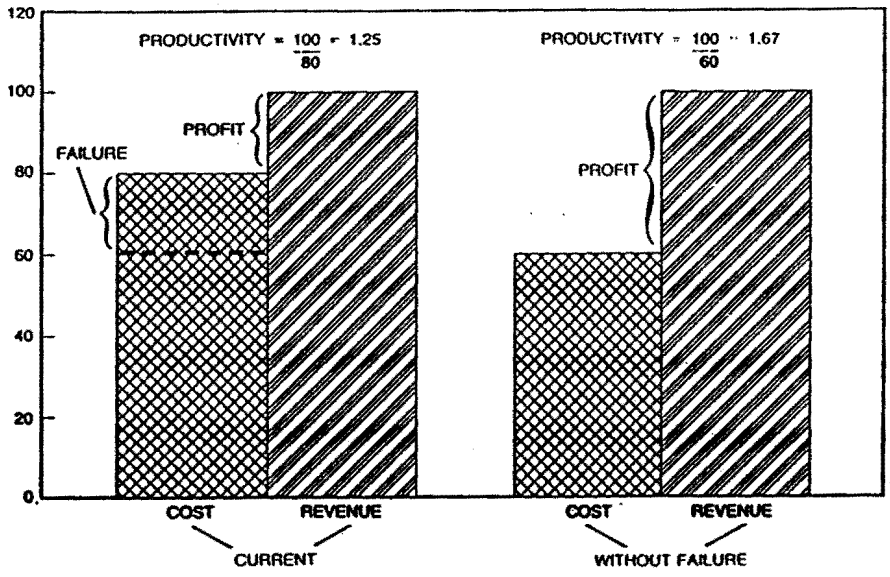

Figure 1. The relationship between quality and productivity. [13, page:6]

Obviously, the potential gain in productivity through quality improvements is very attractive. The direct relationship between quality and productivity has important implications in maintaining a strong competitive position for a company. As Cole [1, page:85] mentions, manufacturers should step beyond the concept of "defect prevention", which is the traditional perception of quality among manufacturers, and reach the "state of the art" definition of total quality control; which involves meeting and, where possible, exceeding customer expectations. In addition to this, Cole [1, page:85] highlights that; a high quality product or service is the one with a quality process. Therefore, the firms; which are committed to achieving high quality products or services, need to focus on improving the quality of every work process in the firm (as measured by the needs of internal and external customers), which as a result affect the productivity of the firm in the positive direction.

1.4. QUALITY AND QUALITY SYSTEM

The meaning of quality, as Shingo [11, page:16] mentions that; prior to the last fifteen years or so, focused on the factory floor, where a product was considered good quality if it was passed by the final inspector. The inspector often practiced much leeway in making this decision, which caused variation in the quality of the products manufactured, due to the variety of the judgements of the inspector. When the reasons for these variations are searched, it is seen that; variations, which cause quality problems at the later stages of the production, start from the designing stage of the product with the "tight tolerances"; where these can not be met by the manufacturing department. When "meeting the needs of the customer" became the

main concern for the manufacturers in the beginning of 1980s, it was understood clearly that the process to assure quality products involves everyone in the company. This concept has great importance as everyone in an organization is both a supplier to others in the organization and a customer. They receive input from others, process it and pass it along to the next customer. Although the external customer is important, the quality of a product depends on the quality of output passed along each internal customer.

These issues, explained briefly above, constitute the basis for a quality system. In the rest of this paper, the approaches to these concepts, from the automotive industry's perspective, and their development processes will be explained, referring to the real applications by the pioneers of the industry.

2. TQM PHILOSOPHY IN THE AUTOMOTIVE INDUSTRY

2.1. QUALITY CONTROL

Shingo [10, page:56] explains the traditional approach to quality as being "inspection". The author [10] points out that, focusing on inspection does not mean producing quality products as inspection does not involve continuous improvement. Besides, the same author [10] describes the inspection methods used in the industry, including also the automotive industry, as below;

Judgement Inspections: Inspections whose sole purpose is to categorize finished products as defective or acceptable after processing has been completed.

Informative Inspections: Inspections in which, when a defect occurs, information to that effect is fed back to the work process involved, which then takes action to correct the method of operation.

Source Inspections: These can be described as inspection methods that, rather than stimulating feedback and action in response to defects, are based on the idea of discovering errors in conditions that give rise to defects and performing feedback and action at the error stage, so as to keep those errors from turning into defects.

After introducing the main approaches to quality assurance briefly, some significant points in the development stages of the Total Quality Management philosophy will be given, so as to identify the path to today's perception of quality, and the basis for Total Quality Management philosophy.

2.2. PIONEERS OF TQM

Although the realization of the importance of Total Quality Management concept in the automotive industry developed in 1970s, these concepts took about twenty years to get to the level of recognition that they deserved. Shingo [11, page:16] points out that, around 1951, quality control methods based on random sampling were introduced in Japan. Besides, the contributions of gurus like Deming

and Feigenbaum to the development of TQM philosophy in Japan can not be disregarded. With the help of these American TQM philosophers, new methods [11, page:16], including the cause and effect diagram, frequency distribution diagram, control chart, sampling inspection, and experiment and planning method, and others were adopted. Shingo [11] indicates that these techniques were welcomed because they provided quality assurance that was less costly and time consuming than 100% inspection.

The next step on the path to TQM in Japan was the Poka-Yoke system, which was developed in Toyota, an automotive industry giant. Shingo [11, pp.21-23] defines this system as the group of methods, using which 100% inspection can be achieved, through mechanical or physical control. There are basically two ways in which poka-yoke can be used to correct mistakes [11, page:21]:

> "- Control type: when the poka-yoke is activated, the machine or processing line shuts down so the problem can be corrected"
>
> "- Warning type: when the poka-yoke is activated, a buzzer sounds or a lamp flashes to alert the worker"

The control type poka-yoke is the strongest corrective device because it shuts down the process until the defective condition has been corrected. The warning poka-yoke allows defective processing to continue if workers do not respond to the warning.

As it is mentioned in the Woodruff and Levine's [14, pp.70-71] article, Japanese companies have focused on comprehensive quality improvement, being the pioneers in this area. They started working with consultants, like Genichi Taguchi, in the process improvement area, as they realized the importance of processes in maintaining the product quality. In the same article [14], the authors state that; U.S. auto manufacturers could only get to the realization of the importance of quality in the early 1970s, with a decrease in their market shares, and started to take action in 1980s so as to catch up with the higher quality of foreign automobile manufacturers, especially the Japanese ones. In 1981, Ford motor company brought in the "big time guru"; Deming. Three years after this, GM did the same, where Chrysler started its quality programs to catch up with the competitors. Although they were late, European car makers like Renault, Volvo and Fiat started implementing Total Quality programs, to be able to survive [14, page:71].

The Total Quality Management techniques used, show a great variety, but in fact; they are based on the same idea: "continuous improvement." After the identification of how TQM became so important, and who the adopters of the TQM philosophy were, in the following sections of this study, the techniques implemented in these different cultures and environments will be explained in detail.

2.3. TQM IN PRACTICE

Hoffer [3, page:24] indicates that; today's competitive auto makers are concentrating their efforts on meeting customers' needs and expectations, and continually improving quality, instead of focusing on internal quality standards. In the same article, Hoffer [3, page:25] points out that; while traditionally quality efforts were focused on finding nonconformities, which is also emphasized by Shingo [10,11], and illustrated in Figure 2.

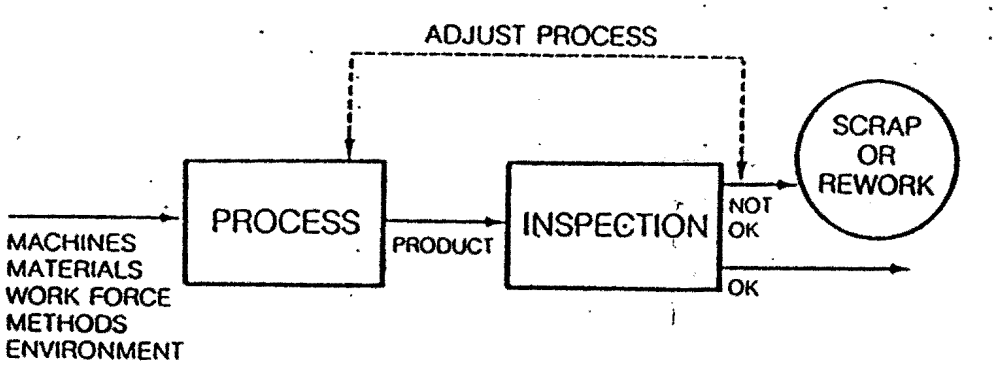

Figure 2. Traditional Approach [3, page:25]

This inherently wasteful system is stated [3] to consume too much human effort, time, materials, and facilities. Today's approach to quality improvement includes the monitoring of the process to determine when adjustments are required to maintain stability and when changes to the process are called for to reduce its inherent variability (Figure 3).

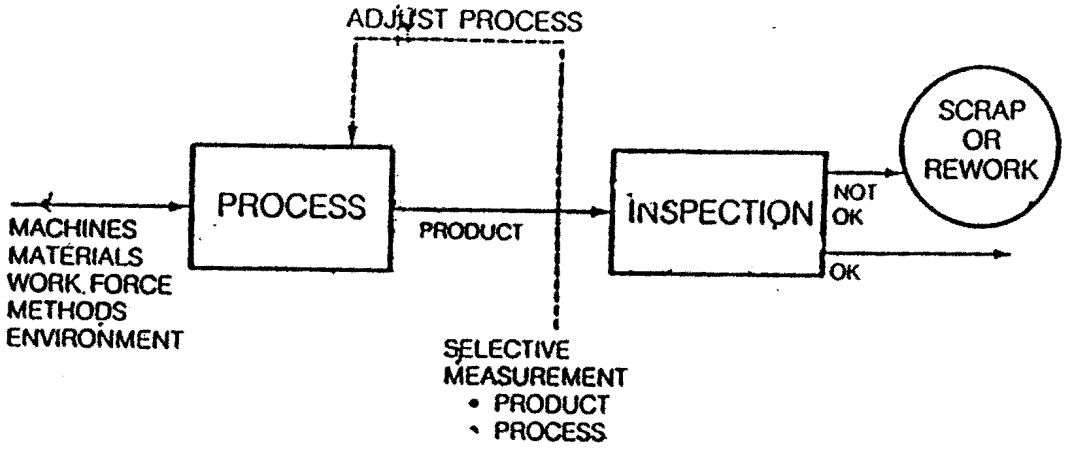

Figure 3. Improved Approach [3, page:25]

Shingo [11, pp.16-25] discusses this approach as being "reactive", instead of "proactive." He suggests poka-yoke system, which was explained earlier. Another approach to quality improvement is the utilization of Taguchi methods. Dr. Genichi Taguchi approaches the quality issue from the "loss" perspective [6, page:11]. Taguchi stresses the importance of designing quality into products and processes, rather than depending on the traditional tools of on-line quality control [4, page:20], which includes judgement and informative inspection methods such as inspecting the products after manufacturing and utilizing Statistical Process Control (SPC) techniques to monitor the variations in the process and to take corrective action accordingly.

In addition to techniques like SPC and Taguchi methods, also improving the processes by setting up world-class facilities like Chrysler did at its Sterling Heights

assembly plant [2, pp.48-52], defining a new production philosophy called "In-line Sequencing." In-line sequencing means that; when the assembly begins, the vehicle remains locked in the assembly system until it emerges, ten miles down the conveyor system. In other words, with in-line sequencing there is a continual and highly predictable flow of material. The product has to keep moving according to a predetermined schedule. If anything goes wrong, it requires immediate correction. Besides, in line sequencing incorporates a just-in-time inventory system, which means that; the parts, which are supplied from outside sources, have to have high quality and be on time. The benefits coming from in-line sequencing, from quality improvement point of view, include [2, page:52];

> "- Elimination of much manual handling of units during production, resulting in less variation."
>
> "- A reduction of number of people in plant support positions, such as repairmen, inspectors and material handlers."

Another TQM implementation example is GM's Buick City plant [12], where teamwork is the main area of concern. Management of the plant agreed with UAW to get the support for their TQM plan, providing their employees with various incentives so as to motivate them and making them contribute to the improvement of the processes by coming up with new ideas. Also, implementing SPC methods heavily and working with their suppliers to make them utilize SPC tools is another dimension of their approach to continuous improvement.

"Concept to Job #1" process in Ford Motor Company [5, pp.7A-1/7a-9] denotes the technical process that begins with product concept, includes product design and engineering, tooling and manufacturing process development, and concludes tooling in place, at launch, ready to produce parts or assemblies at Job #1. CAD/CAM is stated by Moylan [5] as a strategic technology for improving this process. As it is indicated in the article [5], this effort was first initiated in 1985 by setting out a cross-functional team from chief engineers. The goal of the team was stated as to understand the whole process as it exists; to simplify and to improve it. In the later stages it was recognized that all processes can be improved. Plan-Do-Check-Act cycle was utilized for implementing the "Job #1" process. As the results of this TQM practice, the ingredients to successful process improvements within Ford Motor Company are identified as [5]:

> "- A committed owner of the process, ideally one person at an appropriate management level, or a coalition of management stakeholders if the process crosses organizational boundaries"
>
> "- A three level team: management owner, content experts, and facilitator"
>
> "- Adherence to a study process, which assures common understanding of the present process before trying to agree on a vision, and agreement on a plan, with measurables, before initiating major actions"
>
> "- Regular reviews to communicate, continued management commitment, to recognize team achievement, and to guide further implementation and continuous improvement."

It is pointed out [5] in the article that; the methods and results of the Concept to Job #1 study are serving as examples to encourage process improvement throughout Ford Motor Company, worldwide.

3. CONCLUSION

Consequently, this study was very useful in identifying the main trends in approaching the Total Quality Management in the automotive industry. Therefore, regarding the development of the realization of continuous improvement process in this particular industry, it has been observed that, although quality meant only "inspecting the product" twenty years ago, today; it is "everything". Quality is the main issue in the manufacturing of an automobile; starting from the conception phase, to the design, production, assembly, and even in selling to the customer, where after purchase service should not be kept apart from the whole. As perception of quality by the customer is the only differentiating factor for an automobile manufacturer in the eyes of the customer, automotive industry is focusing intensely on TQM and developing new perspectives for achieving continuous improvement.

REFERENCES

[1] Cole, R., "U.S. Quality Improvement in the Auto Industry: Close but No Cigar", California Management Review, Vol.32, Iss.4, pp.71-85, Summer 1990.

[2] Dauch, R.E., P. McEvoy, R.D. Zella, F. Plonka, "New Approaches to Auto Assembly at Sterling Heights", Quality Progress, pp.48-52, April 1985.

[3] Hoffer, P., "Quality in the Driver's Seat", Quality Progress, pp.24-26, April 1985.

[4] Lochner, R.H., J.E. Matar, Designing For Quality, ASQC Quality Press, Wisconsin, 1990.

[5] Moylan, F.E., "Improving the Product and Manufacturing Process from Concept to Job #1", Juran Institute Conference - Atlanta- Proceedings, pp.7A-1/7A-9, 1990.

[6] Ryan, N.E., Taguchi Methods and QFD: Hows And Whys For Management, American Supplier Institute, Inc., Michigan, 1988.

[7] Scherkenbach, W.W., "Performance Appraisal and Quality: Ford's New Philosophy", Quality Progress, pp.40-46, April 1985.

[8] Scollard W.E., "Tooling For Quality", Manufacturing Engineering, pp.41-43, November 1989.

[9] Semple, J., "Why we need TQM - PDQ", Management Today, pp.84-86, May 1992.

[10] Shingo, S., Zero Quality Control: Source Inspection and Poka-Yoke System, Productivity Press, Inc., 1986.

[11] Shingo, S., A Study of the Toyota Production System From an Industrial Engineering Viewpoint, Productivity Press, Inc., 1989.

[12] Stone, H.D., T.A.Jr. Guith, "Buick City: Strategy for Quality and Productivity", Quality Progress, pp.34-38, April 1985.

[13] Winchell, W., Continuous Quality Improvement, Society of Manufacturing Engineers, Michigan, 1991.

[14] Woodruff, D., Levine, J.B., "Miles Traveled, More To Go", Business Week, pp.70-73, October 25, 1991.