A Total Quality Management Information System for Auto Parts Manufacturers in the United States

J. Bandyopadhyay
Central Michigan University

In order to compete in the world markets, American businesses are striving to improve their competitive edges, and one of these competitive edges is quality. Now quality is not only a order winning criteria but also is an order qualifier for many companies. Total quality management (TQM) has been widely accepted as ways and means for achieving excellence in quality in this new millennium by many companies around the world. Multitudes of businesses in manufacturing industry have already implemented or started implementing TQM for achieving quality excellence and improving competitive edge in the world market place This paper presents the results of a survey determining the information needs for implementing total quality management by auto parts manufacturers in the United States and the presents a framework of design and development of a Total Quality Management Information System(TQMIS) for an auto parts manufacturers.

Introduction

As advocated by A.V. Fiegenbaum in the U.S. and Katiro Ishikawa in Japan, Total Quality Management (TQM) involves management and control of quality through out the entire organization (7). In TQM marketing department collects the customer expectation data using market survey (customer / dealers) survey and provides them to product development and design department. Product development and design department in turn designs a selected variety of products to best match the needs and expectations of the target customers as provided by the marketing department. and pass the drawings to manufacturing department for fabrication and assembly. Then, manufacturing department makes parts and assembles the products according to design specifications. Quality control department regularly monitors and inspect production and assembly processes to make sure that parts and assemblies are produced according to product design specifications. Packaging and distribution's responsibility is to package and deliver the product to the customers undamaged and at just in time (8).

TQM emphasizes on customer focus. Product quality is commonly defined as the product's fitness for its intended use which means how well the product meets the needs and expectation of its customers. Again different customers have different needs and expectations. Therefore a product must be designed to meet the needs and expectations of its target customers (1).

Marketing regularly collects and analyzes customers needs and expectation data from customer and dealer surveys and pass them down to product design department. When product design the product by incorporating as many quality characteristics as possible

not just to meet but to exceed customers expectations. This is known as design qualiT TaSuchi, a Japanese Quality advocate, pointed out that products generally fail due to bad design even if manufacturing and quality control is very effective(20). In his book "Taguchi's Method s for Product Design, Taguchi introduced the concept of House of Quality for incorporating customers expectation information into technical-specifications in product design. He also suggested the use of statistical methods of Design of Experiment for prioritizing the customers expectation data before incorporating them into technical specifications of product design. He also suggested the principles of Robust Design in which a product must be designed to withstand any changes in its operating environment (2).

After the product is designed, limited number of products are produced and used for test marketing to receive customer feed backs which are used for refining the design of the product to exceeds ever increasing customers expectations. Moreover, manufacturing must make die product conforming to design specifications and tolerances which is commonly is known as quality of conformance (1).

In current business environment, quality of a product has been regarded very often, as an order qualifier, an essential characteristics for doing business in world marketplace(3) Quality starts in the marketplace Quality is important for two reasons. First, quality is what is supplied to customers in a market place, They are known as external customers. and if the product is defective, these customers will be dissatisfied. and this will result in warranty repairs, return or lost sales and even in product liabilities. Second, if a process produces scrap, it creates disrupted schedules that delay supplying the customer, increases inventory or causes shortages, wastes time and effort on work centers, and increases the cost of the product. Again, the users of the product are also the company's customer, The user could also be the next work station/operation in the production/ assembly lines, commonly known as internal customers. Quality at any one work center should meet or exceed the expectations (needs) of the next step in the process. This is important in being able to maintain the uninterrupted flow of material along the productionlassembly line. If defects occur at one work center and are not detected until subsequent operations, then time will be wasted and the quantity needed will not be supplied (8).

In current business environment quality has been considered as order winning criteria (an essential criteria for winning order) or an order qualifier (a. criteria essential to bidding for an order in world marketplace). For survival and developing competitive edge, businesses must include quality planning as an essential component in their strategic planning process. Strategic planning which involves long-term commitment of significant amount of resources must aim at producing high quality products to meet the customer demand just-in-time. On the contrary, strategic quality planning involves long-term plan and commitment of resources for developing and maintaining a quality assurance system through out the entire organization (15).

Philip Crosby waged a quality crusade through his book "Quality is Free", in which he disputed and challenged the traditional concepts of quality and costs. Traditionally, quality of a product can be improved by improving quality of its components and by using more back up parts which eventually increases the cost of the product. Contrary to this concept, Crosby advocated that if a product is designed and made without defect, it would increase customer satisfaction resulting in increased sales and market share, and significant decrease in costs due to bad quality such as product liability, warranty repair, and scrap costs. With increased sales, products may be produced in large volume using mass scale production technique which eventually increase productivity and reduce cost per unit (3).

Philip Crosby advocated that products must be made without defect at the first place. High quality products increase customer satisfaction resulting in more sales. Satisfied customers not only come back again and again but also bring more new customers. Thus, the market share of a company producing high quality products increases rapidly, On the contrary, that of a company producing low quality product decreases very rapidly (3).

If the requirement is zero defect quality, then manufacturing must assure that defects will not be produced in the first place. This means that the process must be capable of producing the required quality consistently and with as close to zero defects as possible. Manufacturing must do all it can to improve the process to achieve this and then monitor the process to make sure it remains under control Various types of statistical quality control charts may be used for monitoring and controlling the production processes. Daily monitoring can best be done by the operator. If defects are discovered, the process should be stopped and the cause of the defects corrected. Again, Fbka Yokay Systems (mistake-proof devices) may be installed in the processes so that only good quality work-in-process can move to the next work station (5). This technique was introduced by Shingo and is also known as autonomation. Moreover, for a process to continue to produce the required quality, machinery must be maintained in excellent condition, and this can best be achieved through a program of preventive maintenance. This is important for more reasons than quality. Low work-in-process inventories means there is little buffer available. If a machine breaks down, it will quickly have an effect on other work centers. Preventive maintenance starts with daily inspections, lubrication, and cleanup. Since operators usually understand how their equipment should "feel" better than anyone else, it makes more sense to have them handle this type of regular maintenance (4).

In order to carry out all processes involved in total quality management effectively starting from product design to delivery of the product to customers just in time, a large number of data must be collected, stored, processed, analyzed and retrieved(l 1). Proper and speedy collection, processing, storage and retrieval of data using a total quality management information system is critical to the success of TQM in a manufacturing organization (2).

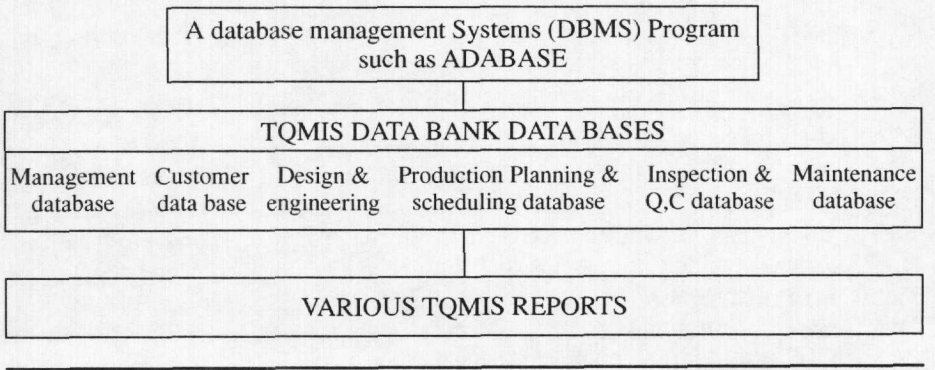
Determining Information Needs for TQMIS

In order to design and develop a realistic Total Quality Management Information System (TQMIS), it was necessary to determine the information needs for successfully implementing total quality management by auto parts manufacturers. For determining critical information needs, 300 Michigan auto parts manufacturers were surveyed, and their Quality manager were asked to identify the critical data bases needed for successfully implementing TQM in their organization. The results of the survey revealed that the following eleven categories of data are essential for successful TQM implementation: (1) quality Policies, (2) quality Procedures, (3) quality Instructions,(4) customers needs & expectations, (5) customer satisfactions and complaints, (6) design specifications and tolerances, (4) engineering & processing instructions, (7) inspection & quality control data, (8) repair & preventive maintenance schedules, (9) employees training & development schedules, , (10) production planning & scheduling data, (11) marketing & sales data. For regularly storing, updating, retrieving, and manipulating these critical data a total quality management information system (TQ1v11S) must be designed developed and installed for successful implementation of TQM by an auto parts manufacturer.

Total Quality Management Information System(TQMIS)

The total Quality Management Information System (TQMIS) is designed as a Database Management System (DBMS) for regularly collecting, storing, retrieving, and manipulating quality related data for effectively implementing total quality management across the manufacturing organization. The TQ1v11S is designed with a data bank containing six distinct databases viz. (1) Management database, (2) Customer database, (3) Design and engineering data base, (4) Inspection & Quality Control data base and (5) Maintenance database, (6) Production planning and scheduling database and a database management system (DBMS) such as ADABASE. as the data storage, organization, retrieving and processing system as shown in Figure 1.

Figure 1. A schematic diagram of a Total Quality Management Information System (TQMIS)



Management database includes management related information and data such as quality policies , quality procedures and quality instructions. Quality policies are management policy declarations for achieving quality excellence and for offering total customer satisfactions, whereas quality procedures are sets of procedures established by the management for implementing the quality policies, and quality instructions are detailed instructions for successfully carrying out quality procedures. Since 100% top management commitment is the essential element of TQM, the management data base is considered to be the most important database in a TQNfiS. Management data base is updated when new policies, procedures, and instructions are introduced or any existing policy, procedure or instruction is changed or modified.

Customer database includes customer needs and expectation data, as well as customer complaints data. Customer needs and expectation data are collected regularly by marketing department through customer survey whereas customer complaints are received as they come, summarized , analyzed and recorded.

Design and engineering database includes design specifications and tolerances, processing, tooling and other engineering data. Design engineers translate customer needs and expectation data into design specifications and tolerances. On the other hand, customer complaints and suggestions are used for design corrections or modifications. Design data are stored in a Master design file, while design data are updated as design modification are made.

Inspection and Quality Control database includes Quality standards, Quality Control (QC) charts, Inspection and Quality Control procedures, rejection and rework data, instrument calibration schedules and logs and other quality related data. While Quality standards, QC charts and QC procedures are stored in a Master Quality file, rejection and rework, and calibration data are stored as they occur, while all other quality related data are updated regularly , and retrieved on demand for analysis and production of management reports.

Repair and maintenance database includes machine tools failure, repair and preventive maintenance data. Machine failure, repair and maintenance data are recorded as they occur, and are analyzed for developing effective repair and maintenance schedules.

Production Planning and scheduling database includes sales forecast and firm orders data, bill of materials, lead times, and other planning data. While sales forecast and firm orders are used to prepare the Master Production schedule, bill of materials and lead time data are used for developing Material requirement planning (MRP) and procurement planning schedules.

The **Data Base Management System(DBMS)** is the systems program (software) such as ADABASE which loads, stores, retrieves and manipulates data and reproduces necessary outputs in desired formats for implementation of TQM through out the organization.

Conclusion

Since gathering data and analyzing them is essential for decision making and implementing control, a Total Quality Management Information System(TQMIS) is essential for successful implementation of TQM in an organization. Besides many small manufacturers, particularly auto parts suppliers are striving to achieve ISO-9000/QS-9000 registration with involves gathering, analyzing, and documenting enormous amount of quality related information, a TQMIS could definitely help in achieving their objectives.

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