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Role of total quality management practices in the development of aviation sector

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ABSTRACT

One of the most important issues that the Aviation field have focused on in the last 20-30 years has been quality. As markets become more competitive, quality has become widely regarded as a key ingredient for success in business. Every organization has quality management practices that enable it to add to the values of its customers and stakeholders. A focused quality management system provides a framework for planning, executing, monitoring and improving performance activities within the organization. This paper mainly discusses the various domains of Quality Management that an organization has to practice to sustain business in the aviation sector.

Keywords— *Quality assurance, Total quality management, Customer satisfaction, Quality control*

1. INTRODUCTION

A Quality Management system is a dynamic, emerging system enveloping over time and space through continual improvement. It is the process of identifying and administering the activities needed to achieve the quality objectives of an organization. For maintaining the complexity and nature of the aviation sector, the major problems arising have to be addressed effectively to keep up with the customer satisfaction levels. Hence, various improvements have been done in the fields of Information Systems, Intelligent Materials Management and Reliability models for providing services that will not only increase customer satisfaction but will also help in increasing the sales and profit of the organisation.

Today's customers demand and expect high quality. Companies that do not make quality a priority risk long-run survival. World-class organizations such as General Electric and Motorola attribute their success to having one of the best quality management programs in the world.

These companies were some of the first to implement a quality program called Six-Sigma, where the level of defects is reduced to approximately 3.4 parts per million. To achieve this, everyone in the company is highly trained in quality improvement principles and techniques to receive a designation called "Black Belt."

The full-time job of Black Belts is to identify and solve quality problems. In fact, Motorola was one of the first companies to win the prestigious Malcolm Baldrige National Quality Award in 1988, due to its high focus on quality. Both GE and Motorola have had a primary goal to achieve total customer satisfaction. To this end, the efforts of these organizations have included eliminating almost all defects from products, processes, and transactions. Both companies consider quality to be the critical factor that has resulted in significant increases in sales and market share, as well as cost savings in the range of millions of dollars.

2. EVOLUTION OF TQM

The Total Quality Management approach originated in the 1950s and had become a popular slogan around the 1980's. The "new philosophy" defined by Feigenbaum was the starting point of all these strategies: Total Quality Control.

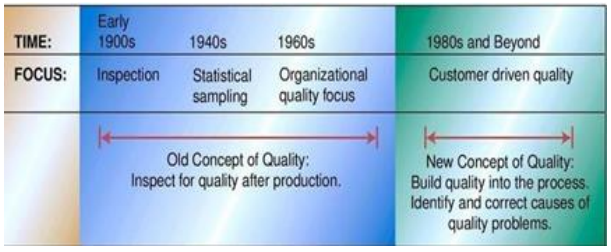

Fig. 1: Evolution of TQM

In 1924, Parallelly W.A. Shewhart developed a statistical chart of control of product variables, which is considered to be the beginning of statistical quality control. In 1946, The American Society for Quality Control was formed and by the 1950s, W. Edwards Deming emphasized the management's responsibility to achieve quality. Thus, Dr. Deming is considered as the Father of Quality Control. Post- World War II, there saw a rise in the contributions of major quality gurus towards the development of the philosophy of total quality management.

In the 1960s, the first quality control circles were formed for the purpose of quality improvement. In the late 1980s, the automotive industry began to emphasize statistical process control. After the 1990s, ISO became the model for quality

management system worldwide. The TQM movement in the USA in the 1980s triggered the quality movement in India in the year 1982 and the Quality circle was born.

	Crosby	Deming	Feigen Baum	Ishikawa	Juran	ISO 9000
Quality definition	Three corners of quality: product, user, instructions for use	Conformance to requirements	What the customer says it is	Satisfactory to the customer	Fitness for use	Conformance to procedures and specifications
Philosophy	Defect Free	Constancy of purpose; Statistical analysis	Full customer satisfaction at economical cost	Company wide quality control	Project Approach; in order of importance	Documentation defines and reflects practice
Approach	Motivate the people	Statistical techniques	Systems approach to total quality control	Talk with data	Quality trilogy; planning, control and improvement	Self-audit with independent review
Mechanics	Fourteen steps	Fourteen obligations of management	The nine "M's	Seven Statistical tools	Diagnostic and remedial journeys	Three ISO 9000 and two guidelines

Fig. 2: Quality definition of gurus versus ISO 9000

In short, the evolution of quality took place across different years in the following stages -
(a) Inspection
(b) Quality control
(c) Quality assurance
(d) Total Quality Management

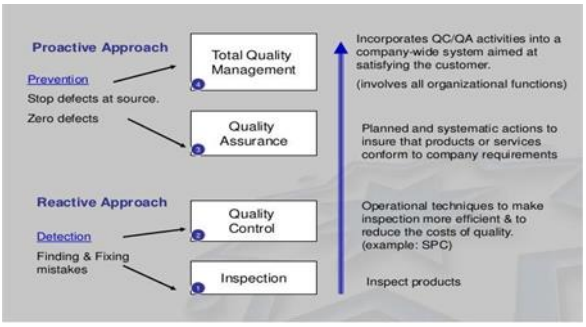

Fig. 3: Approaches in Quality Evolution

3. STRATEGIES IN TQM

The concept of quality has existed for many years, though it's meaning has changed and evolved over time. Today, there is no single universal definition of quality. Quality is now much more a relative term. Some people view quality as "performance to standards." Others view it as "meeting the customer's needs" or "satisfying the customer." Total Quality Management is concerned with controlling activities with the aim of ensuring that products and services are fit for their purposes and meet the standard specifications. The universal process of managing quality is based on three important approaches, namely: Quality planning, Quality Control and Quality Improvement.

Fig. 4: Different phases of Total Quality Management (TQM)

Seven features of TQM combine to create the TQM philosophy: customer focus, continuous improvement, employee empowerment, use of quality tools, product design, process management, and managing supplier quality The .Quality Function Deployment (QFD) is a tool used to translate customer needs into specific engineering requirements. For this, QFD uses a series of matrix diagrams (also called 'Quality tables') that resemble connected houses with different sections.

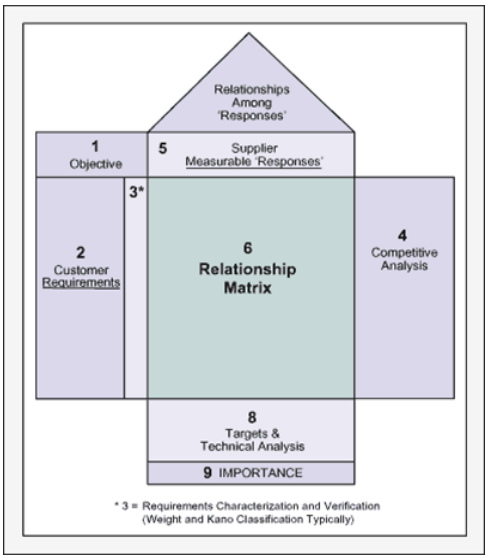

Fig. 5: Quality tables (house matrix)

Apart from this, there are seven problem-solving tools are used in managing quality. Often called the seven tools of quality control, they are cause-and-effect diagrams, flowcharts, checklists, scatter diagrams, Pareto analysis, control charts, and histograms. Intermediate statistical methods are also present for use by quality specialists and managers responsible for quality in their areas. Some of such methods are sampling surveys and inspections, statistical estimations and hypothesis testing, sensory tests and experimental design.

Advanced statistical methods are also used sometimes by specialist quality professionals and consultants. Advanced experimental designs, multivariate analysis and operational research techniques are some of the advanced statistical methods employed for total quality management.

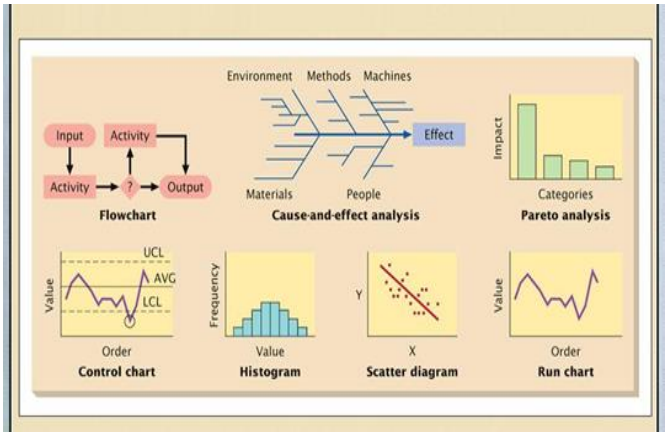

Fig. 6: 7 QC Tools

4. TQM IN AVIATION

Aviation sector comprises of both manufacturing and services industry. Hence, quality has to be maintained all around these different aspects of the sector. Defining quality in manufacturing organizations is often different from that of services. Manufacturing organizations produce a tangible product that can be seen, touched, and directly measured. Therefore, quality definitions in manufacturing usually focus on tangible product

features. In contrast to manufacturing, service sectors produce a product that is intangible. Usually, the complete product cannot be seen or touched. Rather, it is experienced. For these reasons, defining the quality of services can be especially challenging.

Manufacturing Organizations	Service Organizations
Conformance to specifications	Tangible factors
Performance	Consistency
Reliability	Responsiveness to customer needs
Features	Courtesy/friendliness
Durability	Timeliness/promptness
Serviceability	Atmosphere

Fig. 7: Parameters affecting quality in manufacturing and services sector

In the aerospace industry accountability, traceability, documentation and quality of parts are of critical importance. Quality of products according to specification is crucial as it has a profound effect on safety. There are different ways of implementing quality management practices in the Aviation sector. AS9100 is the internationally recognized quality system standard specific to the aerospace industry.

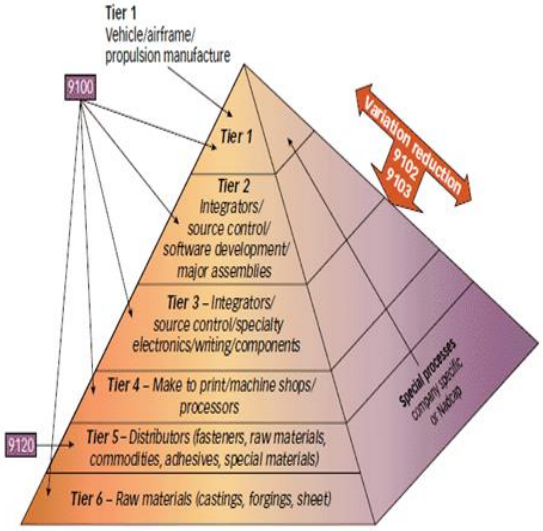

Fig. 8: Supply chain in Aerospace industry according to ISO 9000 Quality standards

The main objective of the aviation sector will always be to satisfy the requirements and expectations of the customer. A quality management system refers to those activities that enable the company to achieve this. It is a complete system that works on the following principles:

- **Establish:** Establish the exact requirements of the customer and the processes needed to achieve them
- **Document:** Document the workflow of these established processes.
- **Implement:** Utilise the processes effectively to achieve the requirements.
- **Maintain:** Maintain these processes, evaluate and measure the results continually.
- **Continual Improvement:** The continuous evaluation and measurement of the processes will point out opportunities for improvement.

ISO offers the PDCA cycle as a useful tool for Continual Quality Improvement (CQI). The methodology applies to both high-level strategic processes and to simple operational activities as shown in figure 9.

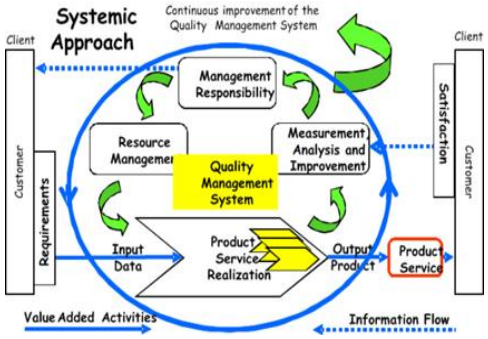

Fig. 9: Quality Management system according to ISO 9000 Standards

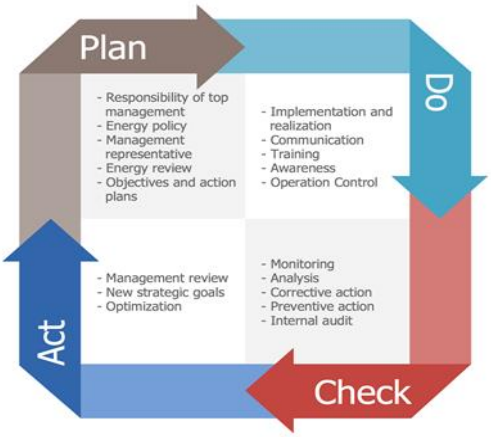

Fig. 10: The PDCA cycle

For a well-organized company, where familiarity with the day-to-day activities is the norm, a properly conducted audit can be beneficial. Audits are about getting information, in a planned way, from a variety of sources and comparing it all to confirm that things are being done properly. Second- and third-party audits are also sometimes conducted and these are collectively known as “external audits”.

5. ADVANTAGES OF TQM

TQM leads to a synergy of benefits, especially for big players in the market, including aerospace industries. The application of TQM empowers all levels of management, from self-management at the worker level, to manage quality systems at organizational levels. The major advantages received from carrying out exceptional quality management practices can be mainly categorized into two. Customer satisfaction oriented benefits:

- Improvement in product quality
- Improvement in product design
- Improvement in the production flow
- Improvement in employee morale
- Improvement in quality consciousness
- Improvement in product service
- Improvement in market place acceptance

Economic improvement oriented benefits:

- Reduction in operating costs
- Reduction in operating losses
- Reduction in field service costs
- Reduction in liability exposure

Other major benefits:

- Tangible gains in productivity
- Increased effectiveness in the use of company resources
- Improved customer loyalty that leads to repeat business

Fig. 11: Benefits of TQM

- Heightened employee and company morale that reduces turnover rates (thereby decreasing costs of training new employees)
- A sense of accountability and an understanding of the individual contribution that fosters open communication and active participation from employees on all levels
- The flexibility that enables fast and appropriate reactions to opportunities and obstacles
- Measured and comprehensive tracking and monitoring systems that are capable of detecting defects, gaps in production and customer satisfaction, and core issues within processes, goals, or functions

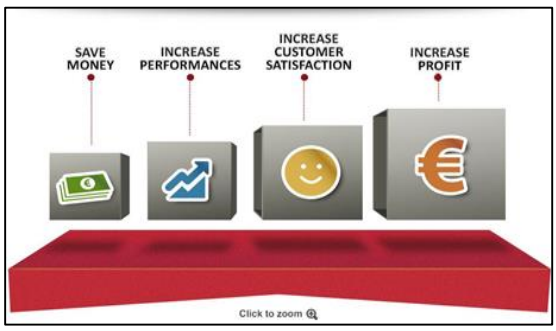

Fig. 12: Advantages of implementing TQM

6. CHALLENGES IN TQM IMPLEMENTATION

The obstacles in implementing TQM are endless. Looking at TQM as a short-term financial investment is a sure recipe for failure. Another mistake is the view that the responsibility for quality and elimination of waste lies with employees other than top management. A third common mistake is over- or under-reliance on Statistical Process Control (SPC) methods. SPC is not a substitute for continuous improvement, teamwork, and a change in the organization's belief system. However, SPC is a necessary tool for identifying quality problems. The obstacles that plague organizations most often are:

(a) Lack of management commitment
(b) Inability to change organizational culture
(c) Improper planning
(d) Lack of continuous training and education
(e) Incompatible organizational structure and isolated individuals and department
(f) Ineffective measurement techniques and lack of access to data and results
(g) Paying inadequate attention to internal and external customer requirements
(h) Inadequate use of empowerment and team work
(i) Failure to continually improve
(j) Lack of identification of proper root cause of problems

7. IMPROVEMENTS IN QUALITY MANAGEMENT TECHNIQUES

Total Quality Management systems have undergone various improvements and integrations over the years.

7.1 Process Reengineering versus CPI

Organizations have started investigating and appreciating the problems in a process to determine if it requires minor healing (continuous process improvement) or major surgery (process reengineering). Both Continuous Process Improvement (CPI) and process reengineering are necessary to drive "breakthroughs" (significant advances) in organizational performances though they differ in many ways. While CPI is the mainstay, process reengineering is employed in certain situations where CPI is not adequate for the job.

7.2 Six Sigma versus TQM

Six Sigma is a relatively new concept as compared to Total Quality Management (TQM). Six Sigma has some differences from TQM — it puts an even stronger focus on customer requirements; which is the primary aim of all businesses. Six Sigma also requires additional tools used in data analysis. The financial focus is on a project level — with TQM, it is on an organizational level.

Both Six Sigma and TQM have many similarities and are compatible in varied business environments, including manufacturing and service industries. While TQM has helped many companies in improving the quality of manufactured goods or services rendered, Six Sigma has the potential of delivering even sharper results.

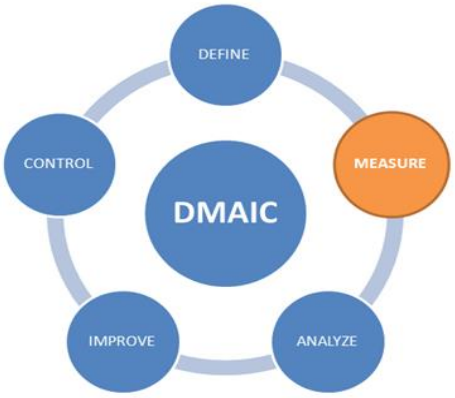

Fig. 13: Principles of Six-Sigma

7.3 Addition of Value Analysis (VA) in TQM

During the design phase, it is also known as Value Engineering. Originally developed by General Electric, Value Analysis looks at reducing manufacturing costs and maintaining the quality and reliability of the product at the same time.

7.4 FMECA in TQM

Failure Mode, Effects and Criticality Analysis (FMECA) is an addition to the earlier existing process of FMEA, which was used widely in quality management practices. It is a systematic approach to anticipate failures and prevent them from occurring. Two types of criticality analysis – quantitative and qualitative was added onto previously existing FMEA technique, to improve quality by isolating problems in a much simpler manner. However, for TQM both FMEA and FMECA are used always in conjunction.

7.5 Improved Information Systems technology in TQM

Information technology has been an age-old contributor to establishing successful quality management practices in the aviation sector. The Information System strategy for TQM in the aviation industry is used not only for eliminating the defects of products and services but also for increasing the service speeds, enhancing product designs, reducing costs and improving the quality of the work.

Using the information system in the management and maintenance of the aviation industry several features could be achieved like updates of the data that would happen in real time, approximately 24/7 uptimes, interfaces that are user-friendly and dual-mode in nature, etc. Through these features easy management of the materials and inventory becomes possible.

AvPro Software is a software tool that could be one of the best examples of the available information system used for quality management in the aviation industry. They have got a various integrated module of software that is stand-alone in nature like the management of inventory, maintenance of the components, work orders, asset management, management of the employee and flight schedule, etc.

Some of the most important factors that could be highly affected by the implementation of such information systems are proficiency and productivity, rapid processing of the passengers, increased satisfaction of the customers, faster distribution of the information, etc. In this era of accelerated technical growth, customers become more information-centric that could be distributed with more velocity. So different information regarding the seat booking, current reservation status, any updating information, etc. can be shared much faster with the help of such information system updates.

7.6 Integration of core stabilization technology for improvement in composite quality checks

All composite materials and processes used in aircraft structures must be qualified through enough tests and fabrication trials to demonstrate reproducible and reliable design criteria. Core stabilisation procedures help in improving material qualification methodology by providing detailed background information on improved engineering practices. It thus ensures stringent quality controls and substantiation of structural integrity for composite structures.

7.7 Integrated Materials Management (IMM) in TQM

Traditional Purchase and Stores functions of the ’70s have graduated to IMM (Integrated Materials Management) in the '90s. Better coordination is now possible through Intelligent Materials Management. Thus, IMM has a very crucial and vibrant role in improving the quality and reliability of products and services in the aviation sector in particular. IMM systems help in improving R and D processes and also act sometimes as an important information center for facilitating the effective flow of quality information.

7.8 APQP and PCPX in TQM

Quality Planning is an important element of quality management to ensure product compliance with the specification and customer requirements, achieve target quality level and on-time delivery performance. However, the conventional way of quality planning lacks identification of potential risk, effective process controls and escape prevention measures resulting in low product yield, low-quality levels, deferred delivery schedules and customer complaints.

APQP (Advanced Product Quality Planning) and PCPX (Process Control Planning and Execution) are a new generation, structured quality planning techniques applied to new product development and process capability improvement. APQP and PCPX help to identify and mitigate the risk early and eliminate sources of systematic process variation thereby aiming at Zero defects and 100% OTD. Thus, APQP and PCPX act as a proactive approach to mitigating potential risks in the aerospace industry.

Fig. 14: Phases in APQP

7.9 Integration of SMS in TQM

Safety Management systems and Total Quality management go hand in hand for ensuring quality as well as safety in the aviation sector. The integration of SMS and QMS is achieved by adding the content concerning the policies, organizational structure, safety assurance and other elements of SMS into the counterparts of QMS. A safety management system is a systematic approach of managing safety, including the necessary organizational structures, accountabilities, policies and procedures.

An SMS can be considered as a “management chain” which defines the essential elements for hazard identification and safety risk management. Both SMS and QMS achieve the overall organization goals, and in particular, the organization’s safety goals through a management system, (that is policies, objectives, organizational structure, procedures, monitoring and the improvements of organizational management.)

A QMS provides basic assurance for the management of quality by means of a process method-PDCA. The SMS provides further assurance for operation quality by identifying, preventing and controlling the safety hazards existing in an operation. QMS cannot, by itself, as proposed by quality dogma, “assure safety”. Because a QMS does not contain the function of identifying (and therefore controlling) safety risks which are inevitable during operations complying with QMS, it cannot positively prevent accidents beforehand and assure safety. It is the integration of SMS into QMS that enhances the possibility of achieving safety goals significantly.

QMS provides a structured and standardized approach for processes and procedures, enabling the SMS to identify hazards and keep safety risks under control. The relationship, therefore, allows the SMS to operate as planned and make improvements when a deviation occurred. The relationship between SMS and QMS is synergistic rather than antagonistic. Establishing a complementary relationship between SMS and QMS leads to the complementary contributions of each system to the attainment of the organization’s safety goals.

7.10 Quality Departments Opting for Strategic Quality Planning

Quality departments and professionals are integrating many quality-related initiatives such as Lean, Kaizen, ISO registration, Six Sigma, and others in their strategic planning processes. Being totally accountable for all results, Six Sigma and lean professionals are spending good time in developing the right quality initiatives and linking each one of them to chief strategic imperatives developed by their QM teams.

8. CONCLUSION

The Aviation industry has benefited from TQM by establishing a quality culture worldwide. Implementing total quality

management requires broad and sweeping changes throughout a company. The decision to implement total quality management concepts throughout the company is strategic in nature. It sets the direction for the firm and the level of commitment. Also, supply chain management is affected as a commitment to quality translates into partnering with suppliers. Thus, every aspect of the operations function must change to support the commitment toward total quality management.

9. REFERENCES

[1] Ahire, S.L. and O'Shaughnessy, K.C. (1998), "The role of top management commitment in quality management: an empirical analysis of the auto parts industry", International Journal of Quality Science, Vol. 3 No. 1.

[2] Ahire, S.L., Golhar, D.Y. and Waller, M.M.A. (1996), "Development and validation of TQM implementation constructs", Decision Sciences, Vol. 27 No. 1.

