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On 27th & 28th February, 2015

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The Significance of Quality Tools on Reliability

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ABSTRACT: Industries face intense competition to survive in the market. This has led to implement action of TQM to eliminate waste and improve profits. However the sustenance of TQM tools has come under scrutiny. In order to handle the critical situation, manufacturers are implementing new innovative techniques to increase effectiveness and efficiency. A literature survey has been conducted to identify the TQM practices in various manufacturing industry. The results indentified that many TQM efforts face sustainability issues. Therefore this paper suggests that TQM has to be integrated with reliability to sustain on long term basis. This paper will help the organizations to align it to the requirements of its customers which would lead to increased competitiveness and profitability

KEYWORDS: sustenance, TQM , sustainability

I. INTRODUCTION

The more intense international competition and increasing globalization make business difficult. Manufacturing work is shifted to developing countries like China, Vietnam or Eastern Europe, where labour costs and taxes are significantly lower. This has led to increased product prices in North America or Western Europe to compete with them. Therefore, their focus has changed to the production of high tech, innovative and complex products like electronic components, cars, airplanes, etc. These types of products are characterized by their quality and require qualified personnel, expertise and a well developed infrastructure. The customer needs increase over time and for the today's customer it is not longer satisfying getting only a defect free product. One of the most important design characteristics, which a manufacturer has to meet, is reliability, because it affects the utility and the total cost of ownership of a product. Therefore, it is important for companies to create awareness for the reliability of their products and processes, and to initiate reliability improvement programs, which ensure that their products and processes will perform their intended functions over the expected period of time. Hence, this paper discusses the relationship between quality and reliability, focusing on the importance and impact of quality tools on product and process reliability

2. Definition of quality and reliability

A common definition states that reliability is equal to the conditional probability that the system will perform without failure its designed-for functions at a given confidence level for a desired period of time when used under stated conditions. These concepts of reliability were developed and initially applied in the military field. The first proven record of the use of reliability techniques is the production of the V1 and V2 rockets in Germany during the Second World War.

Quality: *"The degree to which product characteristics conform to requirements placed upon that product, including reliability, maintainability, and safety."* QS-Norm Draft of Swiss Standard Association, 1981

Reliability: *"Reliability is the probability that a product or system will perform a specified function for a specified time without failure."* Companies are encouraged to give importance to reliability as same as quality management.

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A strong relationship between quality and reliability management must be combined to generate synergy effects, because many similar concepts and tools are required, and the same standards and outputs are shared by both disciplines. Therefore, this paper includes a discussion of some important quality management tools, which support the implementation of stable and robust processes. The problem is that the term 'reliability' is mostly used in a subjective manner and it is difficult to objectively assess progress in this field. Therefore, the reliability measure according to Kumar et al is shown below. This roadmap provides a scientific approach to determine and quantify system reliability

Type of Measure	Description	Metric
Basic Reliability Measures	Predict system's ability to operate without maintenance and logistical support	Reliability Function, Failure Function
Mission Reliability Measures	Predict the system's ability to complete a mission.	Mission Reliability, Failure Free Operating Period, Hazard Function
Operational Reliability Measures	Predict the performance of the system when operated in a planned environment including the combined effect of design, quality, environment, maintenance, etc.	MTBM, MTBO, MFOP, MTBCF, MTBUR
Contractual Reliability Measures	Define, measure and evaluate manufacturer's program	MTTF, MTBF, Failure Rate

Fig 1: Types of measures according to Kumar et al

In order to determine the overall reliability of whole system it must decomposed into sub groups. The reliability of each subgroup is identified and all subgroup reliability is summed up to determine overall reliability. The framework to calculate reliability was given by Sonntag et al and shown in figure 2.

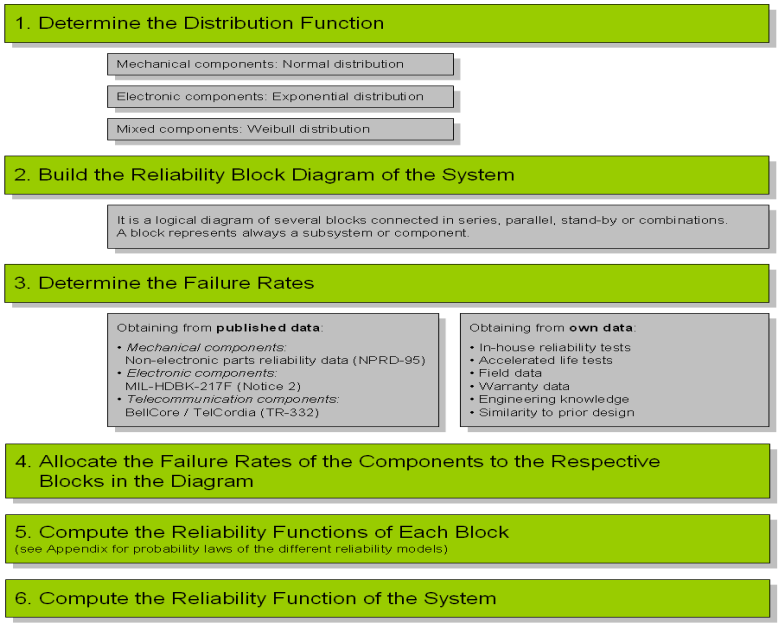

Figure 2: steps to determine reliability of a system

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The knowledge of entire system, its function must be known to identify behaviour of system. The identification of a measurement system for reliability is the first step to make organization more flexible

TQM is the integration of all activities that influence the achievement of higher quality. In this context quality is all-embracing, covering customer perceptions, reliability, value, etc. There is no general TQM model or even a defined approach but every company develops and implements during the time its own TQM system [11]. Each of them is analysing an organization and assessing its TQM system, but their criteria and focuses are partially different. Even though there are differently approaches and objectives, common goals and benefits can be defined. A TQM system has two core requirements: meeting the need of external and internal customers with the delivered products and provided services, and the continuous and detectable effort for improvements. The commitment and involvement of the workforce is always the foundation of a successful implementation. The aspects and the characteristics of TQM can be derived from the name

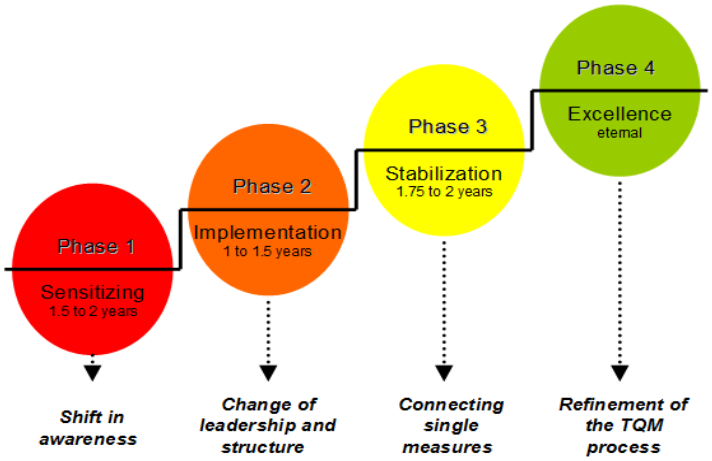

Fig 3: phases of TQM implementation according to Sonntag et al.

II. CONCLUSION

TQM fails because of short term thinking, lack of accountability, top management is not committed the discussion of analysis and quality improvement tools shows that there is a strong correlation between the increase of reliability and the improvement of quality. Both terms are almost similar defined. Reliability can even be stated as a progression of quality by considering the time and environmental conditions. Therefore, the goal is to develop processes, which are capable of executing the intended function and are running for a certain amount of time under routine as well as hostile or unexpected circumstances. Quality is a prerequisite in this context. A new methodology is required to address these common problems and design a system, which provides a proper foundation for the initiation of reliability improvement processes, which combines tools and programs to utilize synergy effects, and which fosters continuous improvements

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