

# Study on Applying Total Quality Management with Maintenance Process Planning in Manufacturing Industries

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## ABSTRACT

*In last decades due to increase the public demand total quality management is receiving global attention from customers, manufacturers and researchers. Total quality management is a system for improving product and operational quality and also it is inevitable for ISO 9000 certificate. This time required recommendation is highly processed to work on good cost effective manufacturing and maintainable production. Purpose of this research is finding minimum scrap in production, required minimum material for production and planning for design and maintainability in simple way to work on total quality management for accuracy, safety, cost effective, customer satisfaction, previously manage to what production required in coming days. Today highly required one product can do multiple works with minimum maintenance work.*

**Keywords:** Quality Inspection, Quality Control, Quality Assurance, Total Quality Management, Data Validity and Reliability, Process optimization, Measuring the Effect of TQM on Product Quality.

## 1. Introduction

Total quality management (TQM) has been characterized as an incorporated hierarchical exertion intended to enhance quality at each level. TQM is additionally characterized as mission of magnificence, wellness for use, esteem for cash, consumer loyalty and so forth. The International Organization for Standards (ISO) characterizes TQM as, "TQM is an administration approach for an association, fixated on quality, in view of the cooperation of every one of its individuals and going for long haul accomplishment through consumer loyalty and advantages to all individuals from the association and to society."

Now focus on Total Quality Management and Maintenance Process Planning is globally very high demand in area of manufacturing and maintenance. These methods are used for finding the production became cost effective with safety work, better quality of product and higher employee satisfaction in working process because employees founded exact work duties in area of work and they are become higher skilled of their work in very minimum time if they are new in work so that process is make higher benefitted to workers and manufacturing industries. For applying total quality management and maintenance process planning in manufacturing firms firstly required study process of work in specific industry and also study to plan for manufacturing to become product cost effective, better quality, to requires seeing in the work to required very higher safety of work for satisfaction of employees to working flexibility to executing process work. Process work means study step to step work in very low cost, safely work, good quality of production applying with better way on your basis on condition.

## 2. LITERATURE REVIEW

In the early twentieth century, quality management meant Inspecting products to ensure that they met specifications. In the 1940s, during World War II, quality became more Statistical in nature. Statistical sampling techniques were used to evaluate quality and Quality Control charts were used to monitor the production process. In the 1960s, with the help of so-called "quality gurus," the concept took on a broader meaning. Quality began to be viewed as something that encompassed the entire organization, not only the production process. Since all functions were responsible for product quality and all shared the costs of poor quality, quality was seen as a concept that affected the entire organization. Since

the mid 80s Total Quality Management (TQM) is considered as the universal remedy for a range of organization problems including organization performance. Today, successful companies understand that quality provides a competitive advantage. They put the customer first and defined quality as meeting or exceeding. TQM is The way of managing organization to achieve excellence, Total – everything Quality – degree of excellence, Management – art, act or way of organizing, controlling, planning, directing to achieve certain goals. All manufacturing processes are imperfect and have an associated non-conformance rate. Manufacturers seeking to achieve higher quality of conformance have a wide range of options to choose from. These can be divided into two categories; improving produced quality of conformance via defect prevention and improving quality of conformance delivered to the customer via inspection. Possible methods of prevention include manufacturing process change or improvement, worker training and supplier audit programs. Management needs information of maintenance performance for planning and controlling the maintenance process. The information needs to focus on the effectiveness and efficiency of the maintenance process, its activities, organization, cooperation and coordination with other units of the organization. Maintenance process planning concept adopts the Performance Measurement system, which is used for strategic and day to day running of the organization, planning, control and implementing improvements including monitoring and change.

The historical evolution of Total Quality Management has taken place in four stages. The can be categorized as follows:

### **1- Quality inspection**

Quality has been evident in human activities for as long as we can remember. However the first stage on this development can be seen in the 1910s when the Ford Motor Company's 'T' Model car rolled off the production line. The company started to employ teams of inspectors to compare or test the product with the project standard. This was applied at all stages covering the production process and delivery, etc. The purpose of the inspection was that the poor quality product found by the inspectors would be separated from the acceptable quality product and then would be scrapped, reworked or sold as lower quality.

### **2- Quality control**

With further industrial advancement came the second stage of TQM development and quality was controlled through supervised skills, written specification, measurement and standardization. During the Second World War, manufacturing systems became complex and the quality began to be verified by inspections rather than the workers themselves. Statistical quality control by inspection –the post production effort to separate the good product from the bad product- was then developed. The development of control charts and accepting sampling methods by Shewhart and Dodge-Roming during the period 1924-1931 helped this era to prosper further from the previous inspection era. At this stage Shewhart introduced the idea that quality control can help to distinguish and separate two types of process variation; firstly the variation resulting from random causes and secondly the variation resulting from assignable or special causes. He also suggested that a process can be made to function predictably by separating the variation due to special causes. Further, he designed a control chart for monitoring such process control and lower evidence of non-conformance.

### **3- Quality assurance**

The third stage of this development, i.e. quality assurance contains all the previous stages in order to provide sufficient confidence that a product or service will satisfy customers' needs. Other activities such as comprehensive quality manuals, use of cost of quality, development of process control and auditing of quality systems are also developed in order to progress from quality control to the quality assurance era of Total Quality Management. At this stage there was also an emphasis of change from detection activities towards prevention of bad quality.

### **4- Total Quality Management**

The fourth level, i.e. Total Quality Management involves the understanding and implementation of quality management principles and concepts in every aspect of business activities. Total Quality Management demands that the principles of quality management must be applied at every level, every stage and in every department of the organization. The idea of Total Quality Management philosophy must also be enriched by the application of sophisticated quality management techniques. The process of quality management would also be beyond the inner organization in order to develop close collaboration with suppliers.

Various characteristics of the different stages in the development of Total Quality Management can be seen in Table 2.1. Here QI, QC, QA and TQM are abbreviations of Quality Inspection, Quality Control, Quality Assurance and Total Quality Management

Stage	Characteristics
<b>QI (1910)</b>	Salvage
	Sorting
	Corrective Action
	Identify sources of non-conformance
<b>QC (1924)</b>	Quality manual
	Performance data
	Self-inspection
	Product testing
	Quality planning
	Use of statistics
	Paperwork control
<b>QA (1950)</b>	Third-party approvals
	Systems audits
	Quality planning
	Quality manuals
	Quality costs
	Process control
	Failure mode and effect analysis
	Non-production operation
<b>TQM (1980)</b>	Focused vision
	Continuous improvements
	Internal customer
	Performance measure
	Prevention
	Company-wide application
	Interdepartmental barriers
Management leadership	

Crosby (1982) on the other hand was not keen to accept quality which is related to statistical methods. According to him quality is conformance to requirement and can only be measured by the cost of non-conformance. Crosby provides four absolutes

1. Definition of quality – conformance to requirements.
2. Quality system – prevention.
3. Quality standard – zero defects.
4. Measurement of quality – price of non-conformance.

#### **4. JUSTIFICATION OF STUDY**

Indian manufacturing companies continue to face viability challenges and competition from cheap product manufacturing finding their way in the country through porous borders. Business with better competition strategies will live to see the next day. Increased customer demand have become extremely important challenges facing most Indian manufacturing companies. So there work proceeding securely to do things the work process on manufacturing suitable to level automation machine use because we found better quality with lower cost of production so I study on the total quality management and maintenance process planning status on work to measure the suitable work on it factors of finding quality in lower cost

Indian manufacturing sector has continued to face problems, and among them is a high production cost emanating from lack of export competitiveness on the international market. The low drive in competitiveness has had a negative impact on capacity utilization. The same report has indicated that failure to meet quality requirements of international buyers, has been one reason why some Indian manufacturing companies have failed to enhance their competitiveness.

## 5. METHODOLOGY

The population of interest in this study was the Indian manufacturing companies, who had some TQM systems running or those at an advanced stage of quality management systems implementation. A sample of 4 firms, of various sizes. The firms were drawn from three major cities of Indian, namely JMC Industries at New Delhi, IPCA Laboratories Limited Mumbai and Sikkim plants, L&T Construction at Klinga Nagar Orissa. In these companies I take training and working TO study for the TQM and MPP. I make figures to optimizing the cost of production, quality, inspection of welding, finishing

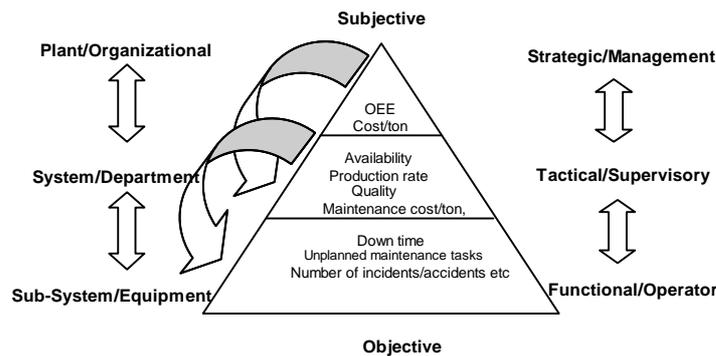
## 6. DATA ANALYSIS

For this research, data was analyzed for trends and conclusions were also made based on the analysis of numeric data, thus both inferential and descriptive process planning were used in this research.

### 6.1 DATA VALIDITY AND RELIABILITY

The two major types of validity used in this research are, content validity and construct validity. Content validity was subjectively judged by the researcher. To address content validity in this study, a thorough review of available TQM and MPP literature together with working performance measurement were conducted. Furthermore, the original questionnaire was submitted to business and TQM experts to get an expert opinion on the content of the questionnaire. The construct validity describes how the investigation as an entity can be generalized in an appropriate way. This study was based on a theoretical framework that is built on well-known "TQM gurus", thus allowing the work to be generalized.

#### 6.1.1 INTEGRATION OF MAINTENANCE STRATEGIC LEVEL



#### 6.1.2 FACTORS TO WORKING STUDY SCHEDULES

##### *Technical integrity*

- Backlog preventive maintenance (man-hours).
- Backlog corrective maintenance (man-hours).
- Corrective work orders.

##### *Maintenance parameters*

- Maintenance man-hours safety system.
- Maintenance man-hours system.
- Maintenance man-hours other systems.
- Maintenance man-hours total.

##### *Deferred production*

- Due to maintenance.
- Due to operation.
- Due to drilling/well operations.
- Weather and other causes.

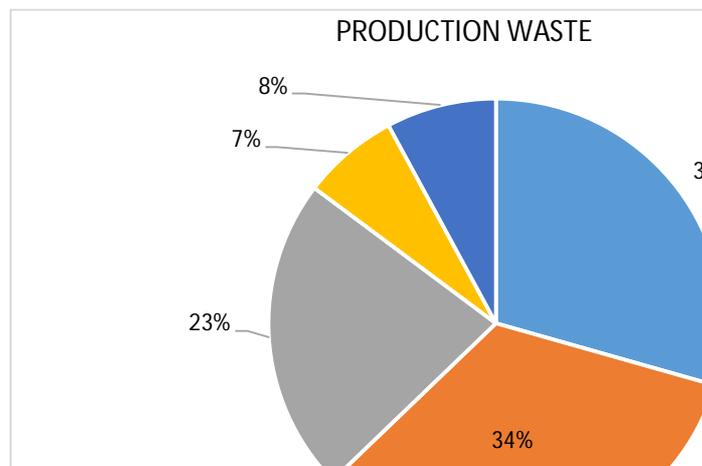
**6.2 RESULTS AND DISCUSSION**

**6.2.1 Process Optimization**

**6.2.1.1 Production waste**

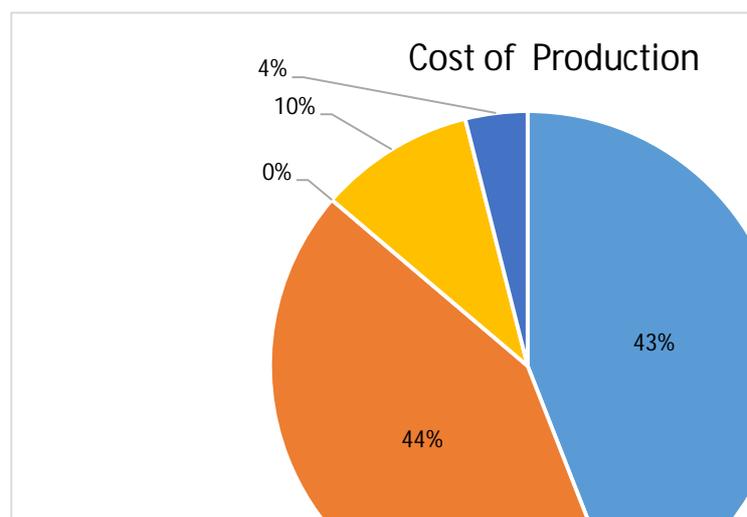
Production waste analysis is aimed at ascertaining how much TQM can contribute to the reduction of production waste, and in this study, how much of raw materials will be converted into the final product. For this study changes in production wastes were considered to be positively related to changes in quality costs (COQ). The higher the costs the higher were production waste. From the questionnaire results, 30% of the respondents strongly agreed that as a result of TQM production wastes reduced, and some of the responses are as tabulated below.

In support of primary data, secondary data results revealed that COQ was, on average, 46% of sales revenue against a target of 31% in the first year of TQM adoption, and it dropped to 43.5% a year later. A significant reduction to 26% was recorded two years after the inception of TQM. For most of the companies investigated, the fourth year recorded a COQ average of 15.9%, giving an average total reduction, in COQ, of 28% in a period of four years.



**6.2.1.2 Costs of Production**

Analyzing the effects of TQM on costs of production was aimed at determining the effectiveness of TQM in enhancing production efficiencies. Forty two percent of the respondents strongly identified TQM, in their systems, with improved efficiencies. Only 4% strongly disagreed of any positive changes on efficiencies as a result of TQM adoption.

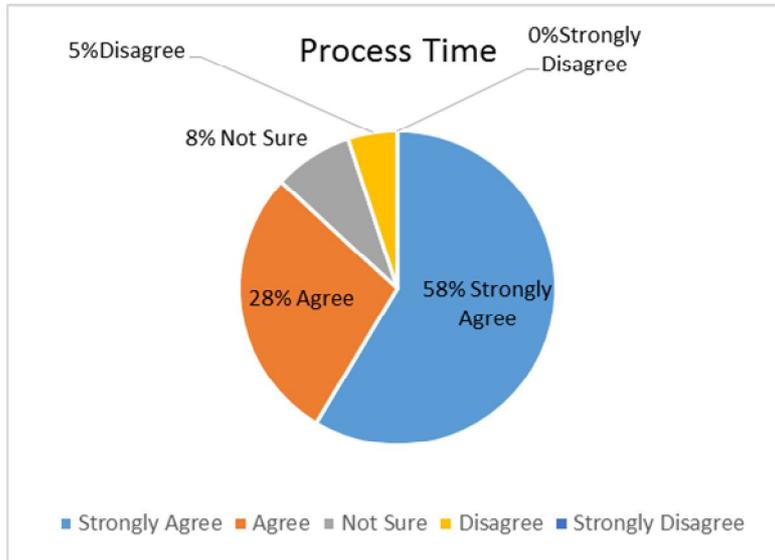


Basing costs of production on the use of a single factor of production, that is labor, secondary data analysis showed a fall in production costs, from 69.3% to 67.7% between the first two years of TQM adoption. A more noticeable decline, of 13.8%, was realized between the second and third years. The fourth year recorded a 48% cost of labor, against an average target of 46%.

**6.2.1.3 Process Time**

Process time represents the period in which one or more inputs are transformed into a finished product by a manufacturing procedure. TQM adoption was aimed at reducing this process time to the minimum possible. As a result of TQM 86% respondents realized some improvements in their processing time.

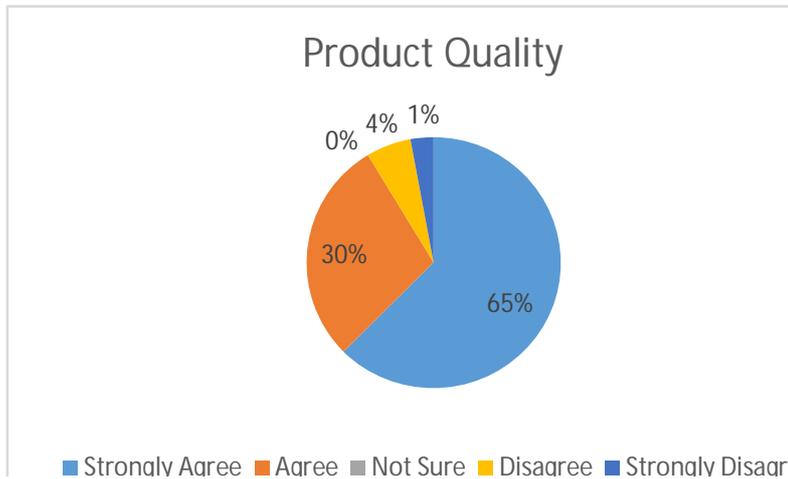
Secondary data was in consistency with survey results. In one particular case, the first year of TQM adoption recorded a 37 hour time period to complete one batch, the second year recorded an 11 hour drop in processing time, to 26 hours, the fourth year recorded an even lower processing time of 21 hours, a process efficiency improvement of 43%, in a four year period.



**6.3 Measuring the Effects of TQM on Product Quality**

**i) Product Quality**

A total of 65% respondents were in total agreement that TQM systems, in their companies, helped in improving product, only 1% strongly disagreed of such effect.



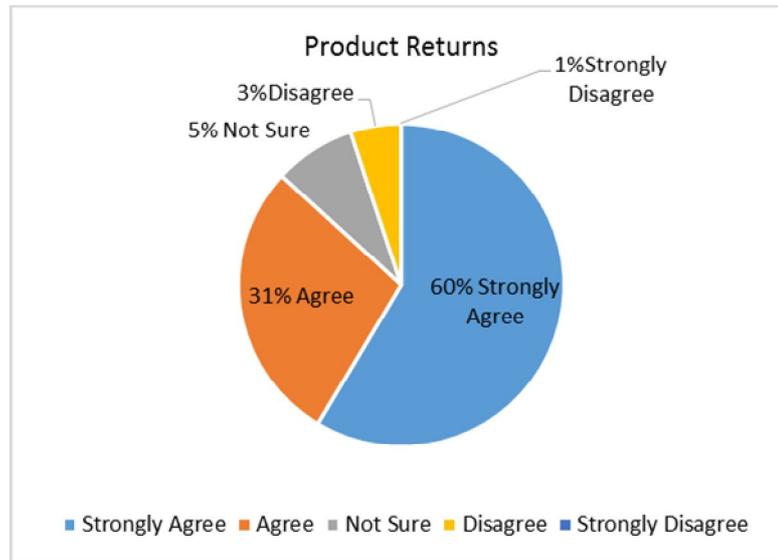
An analysis of quality records strengthened and supported the positive effects of TQM on product quality. There was a reduction in product defects from, an average of, 18% in the first year of TQM adoption to 6%, of total production, in the fourth year.

**ii) Product Returns**

Low product return signifies high levels of TQM effectiveness. The purpose of this question is to determine if the results from this study supported previously recognized TQM literature, that TQM improves product quality, thus reducing the rate of product rejection, and the questionnaire results came out as follows;

An analysis of secondary data did confirm the theory and survey results. In the first years of TQM adoption, failure and or rejection rate stood at 2%, the figure fell to 1.6%, 1% and finally to 0.6% in second, third and fourth year

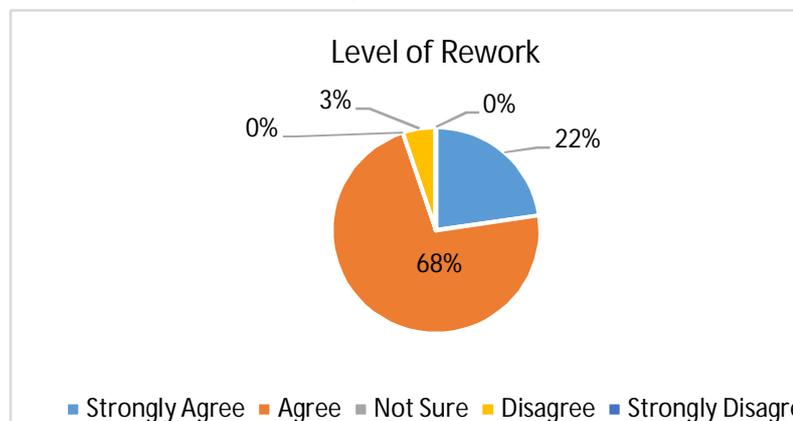
respectively. The drop in failure rate was literally translated into improved product quality thus a reduction in product returns.



**iii) Levels of reworks**

Rework is a cost to the company in terms of labour, material and time. The purpose of measuring the level of reworks is to ascertain the extent to which TQM has helped in rework reduction, thus proving its suitability as a tool in enhancing competitive advantage, through costs reduction. Ninety seven percent of the respondents were positive that their companies were recording a reduction in the levels of rework, with only 3% disagreeing that TQM has brought about a reduction in reworks.

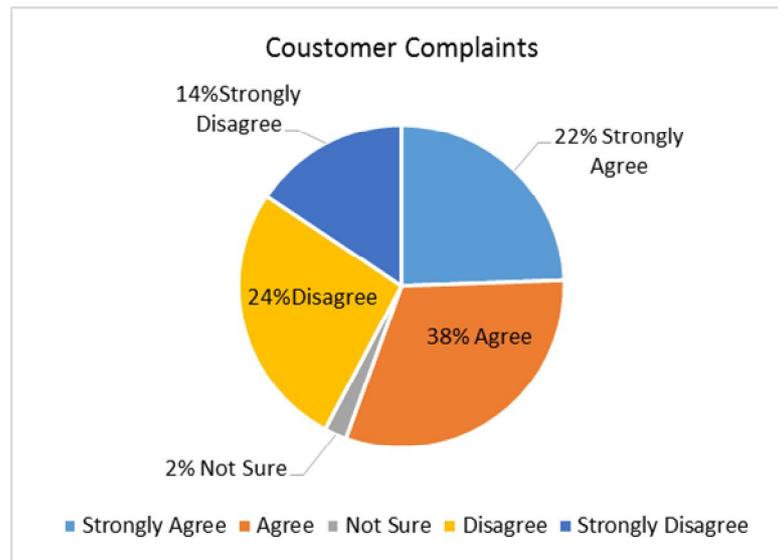
Secondary data, supported survey results, reworks fell substantially from 8.5% to 7.3% between the first and second years of TQM inception in company systems. The figure fell, to 5.1%, between the second and third, was followed by a drastic one in fourth, where reworks were at 2.1% of total production



**iv) Customer Complaints**

The purpose of measuring customer complaints was to determine how attractive the business products had become with the adoption of TQM. The higher the number of complaints the less attractive the business offerings were. Twenty two percent of the respondents strongly agreed that their organizations were recording less, than before, complaints since the adoption of TQM, with 14% strongly disagreeing to this effect. Two percent were however not sure of the effects of TQM towards customer complaints.

Secondary data analysis revealed that in the first year of TQM adoption, a total of 108 complaints were recorded, for all the survey companies. Complaints increased to 138, a year after. With the maturing of TQM, complaints fell to 98 in the third year, with the fourth year recording 72 complaints.



## VI. DISCUSSION

Process optimization, product quality, sales and stakeholder relationship were measured from the feedback of study sample respondents, by means of questionnaire and historical data. From the results, the majority agreed that production waste reduced as a result of TQM. The same is true with costs of production, a majority of 85% supported the point that with TQM costs will reduce. It was also supported by 88% of the respondents that process time reduced as a result of TQM. The same goes for all the other elements measured, defect rate, return and reworks, sales volumes and partner relationships had all above 81% confirmation that they improved as a result of TQM. Areas of concern were noticed on the responses on customer complaints, sales revenues and market share, were positive response average between 51% and 59%. Only quality managers and a few employees responded positively to these elements, thus showing that the questions might have been a challenge to most. Secondary data came in support of literature, and it has thus been concluded that a TQM system statistically controlled is an enabler of competitive advantage to manufacturing companies.

## VII. RECOMMENDATIONS

The findings of this study are in consistent with the findings of the previous research, and self-knowledge is in this research which supports the point that a combination of TQM and MPP adaptation enhances business competitiveness. It is thus recommended that TQM and MPP guided by performance indices should be adopted for Maintenance and production enhancement.

## VII. CONCLUSION

TQM demands major organizational commitment, effort and resources, thus there is need of clear evidence that it enhance business competitiveness. To recognize this success the process needs to be kept under a rigorous statistical control process for continuous monitoring, control and measurement, thus allowing variation monitoring and controlling. The main objective, of the study, was to provide empirical evidence on the possible outcomes that may be expected from those companies willing to adopt TQM and MPP. It is concluded that TQM enhances competitiveness through improved process optimization, improved product quality and improved stakeholder relationships.

## VIII. FURTHER WORK

This study is considered as the first, or one of the few attempts to identify impact of TQM and MPP on the enhancement of business competitiveness for manufacturing industry. Direction of further research is therefore suggested. Victory become only from Practice planning a detailed study of the performance indices influencing the enhancement of competitive advantage is warranted. Such kind of study would provide good insight on the effectiveness of the indices as a measurement of success.

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## AUTHOR PROFILES



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