

Total Quality Management: A Critical Component for Effective Delivery of Manufacturing Project

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ABSTRACT : *The world becoming a global village comes with its challenges. One of such challenge is that both local and international manufacturing firms are engaged in fierce competition of winning customer's loyalty through Total Quality Management (TQM). The methodology of this paper used both questionnaire and statistical tools like t-test, F-test, ANOVA, regression and correlation analysis to study the components of TQM and how they affect effective delivery of manufacturing projects. The result of analysis indicates that staff training, staff empowerment, genuine quality culture, top management support, quality-based custom design and product improvement are critical to effective delivery of manufacturing projects. It is therefore very important that for the transformation of the nation, manufacturing sector of the Nation must imbibe the culture and practice of Total Quality Management in their product development and delivery.*

Keywords: TQM, Sustainable Competition, Manufacturing, Project Delivery

1. Background of Study

It has been discovered in recent years that whatever type of manufacturing organization you work in, competition is rife: competition for customers and for resources. Any organization basically competes on its reputation for quality, reliability, price and delivery and most people now recognize that quality is the most important of these competitive weapons. Many industries have used quality strategically to win customers, steal business resources or funding and be competitive.

Total Quality Management (TQM) is far more than shifting the responsibility of detection of problems from the customer to the producer. It requires a comprehensive approach that must first be recognized and then implemented if the rewards are to be realized. Today's business environment is such that managers must plan strategically to maintain a hold on market share, let alone increase it. We have known for years that consumers place a higher value on quality and price is often not the major determining factor in consumer choice. Price has been replaced by quality and this is true in manufacturing, service, hospitality, and other markets.

Total quality management is an approach to improving the competitiveness, effectiveness and flexibility of a whole organization. TQM is an integrated management philosophy and set of practices that emphasizes, among other things continuous improvement, meeting customer's requirements, reducing rework, long-range thinking, increased employee involvement

and team work, process redesign, competitive benchmarking, team-based problem- solving, constant measurement of result and closer relationship with suppliers (Ross, 1993). Its adherents claim that managers can implement TQM in any organization, manufacturing, service, non-profit, or government and that it generates improved products and services, reduced costs, more satisfied customers and employees, improved bottom line financial performance and sustainable competitive advantage over its competitors.

TQM is essentially a way of planning, organizing and understanding each activity, and depends on each individual at each level. For an organization to truly sustain its competitiveness in the market, it must work properly together towards the same goals, recognizing that each person and each activity affects and in turn is affected by others. TQM is also a way of ridding people's lives of wasted effort by bringing everyone into the processes of improvement, so that results are achieved in less time. Some of the key benefits of TQM to organization are; improved product quality, higher employee productivity, increased job satisfaction, consistent platform for co – operation, employee development, more visible constructive interaction between departments, increased awareness of organizational efforts to improve quality, facilitates sustainable competitive advantage on manufacturing project delivery, decreased time to market, higher customer service and return etc.

1.2 Statement of Problem

In Nigeria today, the desire for high quality products rapidly increases on daily basis, this is because virtually everyone has experiences of poor quality when dealing with business organization. These experiences might involve a purchased product that is damaged or defective and these has caused organizations their reputation towards their customers which leads to lose of sustainable competitive advantage the organization has enjoyed. Irrespective of the great benefits that can be attained through the implementation of TQM, yet there are still many companies that attempt a variety of quality improvement efforts and find that they have not achieve any or most of the expected outcomes.

However, there are problems manufacturing industries have encountered in recent years that have prevented them from competing successfully and in the delivery of manufacturing project.

The problem of TQM towards ensuring that manufacturing organization sustains its competitive advantage is lack of genuineness in organization's commitment. Often companies look at TQM as another business change that must be implemented due to market pressure without really changing the values of their organization. Some organization put too much emphasis on short – term financial performance at the expense of research and development. Research and development is important in manufacturing organization, for it help to identify the best method of creating a new product develop the product in other to maintain her competitiveness in the market. In other words failing to consider customer wants and needs have created problems for manufacturing industry. The key to successful competition is to determine what customers want and then directing efforts toward meeting (or even exceeding) customer expectations. Operations must work with marketing to obtain information on the relative importance of various items to each major customer or target market. Some manufacturing organizations lack systematic method for listening to their customers, collecting and analyzing data pertaining to customer problems and making changes based on customer feedback. This means that there is no systematic process for prioritizing the customer needs that encompass the entire organization. Some companies introduce TQM without monitoring costs, staffs were not adequately trained, employees were not empowered and lack of strong leadership and it has become a problem for such companies to compete successfully in the market.

It has been a problem the view that the responsibility for quality and elimination of waste lies with employees other than top management. It is a “let the workers do it” mentality.

Furthermore, the problem most of the manufacturing firms are facing is that they solely delegate the issue of total quality management to quality control department of the organization without knowing that quality control is entirely the responsibility of every department including the top management. For instance, a company cannot achieve high quality if its accounting is inaccurate and the marketing department is not working closely with customers. The human resources department is critical to the effort to hire employees with the skills necessary to work in a TQM environment. Engineering department efforts are critical in TQM because of the need to properly translate customer requirements into specific engineering terms and design. TQM requires the close co-operation of different functions in order to be successful.

1.3 Objective of the Study

In appreciation of the problem as described above, the following objective shall be vigorously pursued.

1. To ascertain the level of effect of TQM for sustainable competitive advantage on manufacturing project delivery.
2. To reveal the importance of genuine quality culture and top management support and commitment in effective delivery of manufacturing project.

3. To ascertain the effect of closer customer relationship, staff training and empowerment for sustainable competitive advantage on manufacturing project delivery.
4. To ascertain the effect of customer defined quality and continuous improvement principle in the effective delivery of manufacturing project.

1.4 Scope of Study

The research work focuses on Total Quality Management as a factor of sustainable competitive advantage for effective delivery of manufacturing projects. The research work was carried out with the aid of questionnaire distributed to selected manufacturing industries in Aba, Abia state, south eastern part of Nigeria.

2. Research Gap

Having reviewed thoroughly the various research works on Total Quality Management the researchers have failed to examine properly some issues relevant to total quality management as a factor of sustainable competitive advantage in the effective delivery of manufacturing project. They could not ascertain in their work the level of effect of TQM for sustainable competitive advantage on manufacturing project delivery, the extent in which genuine quality culture and top management support and commitment are relevant to effective delivery of manufacturing project, the extent of which closer customer relationship, staff training and empowerment relevant to sustainable competitive advantage in manufacturing project delivery and the level of effect of customer defined quality and the principle of continuous improvement to the sustainability of organization's competitive advantage on manufacturing project delivery.

Therefore the purpose of this research is to breach the gap as created by the past research works and to carry out more research as it concern Total Quality Management and how it affects manufacturing companies in its quest to achieve sustainable competitive advantage in manufacturing project delivery.

3. Research Approach and Design

This study is a descriptive study survey. The research involved the use of mail questionnaires administered to private owned manufacturing firms and government owned manufacturing industries in the south eastern part of Nigeria to obtain information from a considerable number of top managers, middle – level, low level managers, industrialist, manufacturers and other experts in this field of research. The survey is a type of descriptive study in which information is obtained from a sample of respondents for answering research question and hypothesis concerning TQM: a factor of sustainable competitive advantage for effective delivery of manufacturing projects. The research methodology for this work also includes a comprehensive literature review and a statistical analysis of the surveyed data.

3.2 Population of the Study

The population of this study is the totality of organization or persons that have the capacity, ability and capability and responsibility of either to carry out or conduct TQM exercise, and monitor its compliance for sustainable competitive advantage for effective delivery of manufacturing project. But for the purpose of ease and accessibility, the population has been delimited to manufacturing organization with the above characteristics in Abia State, south eastern part of Nigeria.

4. Data Presentation, Analysis and Discussion of Findings

Model Estimation and Hypothesis Testing

The model estimation and hypothesis testing was carried out using the various outputs of the statistical package for social science (SPSS) which was used to carry out the regression analysis of the respondents.

Table i: Correlation Analysis

		Y	X ₁	X ₂	X ₃	X ₄
Pearson Correlation	Y	1.000	.804	.725	.666	.506
	X ₁	.804	1.000	.791	.607	.696
	X ₂	.725	.791	1.000	.660	.584
	X ₃	.666	.607	.660	1.000	.599
	X ₄	.506	.696	.584	.599	1.000

Source: Researchers' Computation (SPSS Version 17)

Dependent variable Y: Effective delivery of manufacturing projects.

Independent variables X₁: Staff training and empowerment, X₂: Genuine quality culture and top management support and commitment, X₃: Quality-based custom design product and X₄: Continuous improvement principle in total quality management.

4.1 Correlation Analysis:

Correlation analysis is a technique used in measuring the closeness of the relationship between variables or among variables. It helps in ranking the variables based on their level of correlation. From table i, it could be observed that the variables are ranked from highest to lowest. That is Y, X₁, X₂, X₃, and X₄. The table also showed that there is a high correlation between Y and X₁ of 0.804, Y and X₂ of 0.725, Y and X₃ of 0.666 and Y and X₄ of 0.506. It can be observed that among the independent variables the correlation of X₁ and X₂ is the highest with correlation of 0.791. Other variables relationships are X₁ and X₃, 0.607, X₁ and X₄ of 0.696, X₂ and X₃ of 0.660, X₂ and X₄ of 0.584 and X₃ and X₄ of 0.599. This means that there is a high correlation between all the variables indicated in the table i and all the variables are significant.

4.2 Model Summary

The model summary from statistical package for social sciences (SPSS) output is shown below.

Table ii: Model Summary

Model	R	R ²	Adjusted R ²	Standard Error of the Estimate	Change Statistics	
					F Change	Sig. F Change
	0.850	0.723	0.702	1.02892	41.046	0.000

Source: Researchers' Computation (SPSS Version 17)

It can be depicted from the table ii, that the R² is 0.723 meaning that 72.3% of total quality management a factor of sustainable competitive advantage for effective delivery of manufacturing project can be accounted for in our model. Also our model is very reliable since F Change is 0.000 as shown in the table above. The unaccounted factors not covered in this project are 27.7%. Further research into identifying such factors can improve the value of R².

4.3 F-Test (ANOVA)

The analysis of variance (ANOVA) table is shown below.

Table iii: ANOVA

Model		Sum of Squares	Degree of freedom	Mean Square	F	Significant.
1	Regression	173.818	4	43.455	41.046	.000
	Residual	66.696	63	1.059		
	Total	240.515	67			

Source: Researchers' Computation (SPSS Version 17)

Table iii presents the ANOVA report on the general significance of the model. As F significant of 0.000 is less than 0.05 level of significant, the model is significant. Thus the combination of the independent variables X₁, X₂, X₃ and X₄ significantly predicts the dependent variable Y. These thus lead to rejecting H₀₁ and accepting H_{A1}, which states that Total Quality Management (TQM) in manufacturing project is significant for sustainable competitive advantage. This is of course true considering that X₁, X₂, X₃ and X₄ are component factors of Total Quality Management (TQM).

4.4 Coefficients

Table iv: Coefficients

Model	Unstandardized Coefficients	Standardized Coefficients	

		Beta	Std. Error	Beta	t	Sig.
1	(Constant)	4.676	1.822		2.567	.013
	X ₁	.623	.113	.679	5.529	.000
	X ₂	.139	.150	.109	.931	.356
	X ₃	.269	.081	.312	3.311	.002
	X ₄	-.268	.120	-.218	-2.238	.029

Source: Researchers' Computation (SPSS Version 17)

Table iv showed the unstandardized Beta coefficients that present the contributions of each variable to the model. The t and P-values showed the impact of the independent variables on the dependent variable.

4.5 T-Test

From the table it can be deduced that X₁ (Staff training and empowerment) and X₃ (Quality-based custom design product) are more significant factors affecting the effective delivery of manufacturing project. This is because they have significant values of 0.000 and 0.002 respectively. The conclusion drawn from here is that while four factors affect the effective delivery of manufacturing project collectively, the main impact is as a result of X₁ and X₃.

4.6 Regression Model and Interpretation

With the above table, the model can be generated as

$$Y = 0.679X_1 + 0.109X_2 + 0.312X_3 - 0.218X_4 + 1.02892 \dots \dots \dots 4.1$$

The equation can be used to predict the effective delivery of manufacturing projects.

Where

Y = Effective delivery of manufacturing projects

X₁ = Staff training and empowerment

X₂ = Genuine quality culture and top management support and commitment

X₃ = Quality-based custom design product

X₄ = Continuous improvement principle in total quality management.

That is:

Effective delivery of manufacturing project = 0.679 Staff training and empowerment + 0.109 Genuine quality culture and top management support and commitment + 0.312 Quality-based

custom design product - 0.218 Continuous improvement principle in total quality management.

From the model, it can be concluded that staff training and empowerment should be considered most. The next is quality-based custom design product, followed by genuine quality culture and top management support and commitment, and lastly continuous improvement principle in total quality management.

4.7 Test of Hypothesis

HO₁: TQM in manufacturing project is not significant for sustainable competitive advantage. Since F significance is 0.000, which is less than 0.05 significance level, we reject H_{O1} and accept H_{A1} and conclude that total quality management in manufacturing project is significant for sustainable competitive advantage.

HO₂: Genuine quality culture and top management support and commitment are not significant for effective delivery of manufacturing project.

Since t significance is 0.356 is greater than 0.05 we accept null hypothesis (HO₂) and reject alternative hypothesis (H_{A2}) and conclude that genuine quality culture and top management support and commitment are not significant for effective delivery of manufacturing project.

HO₃: Quality – based custom design product has no significant effect for sustainable competitive advantage on manufacturing project delivery.

Since t significance is 0.002 which is less than 0.05 significance level, we reject H_{O3} and accept H_{A3} and conclude that quality-based custom design product has a significant effect for sustainable competitive advantage on manufacturing project delivery.

HO₄: Continuous improvement principle in TQM is not a significant strategy for sustainable competitive advantage in manufacturing project delivery.

Since t significance is 0.029 which is less than 0.05 significance level we reject the null hypothesis (H_{O4}) and accept the alternative hypothesis H_{A4} and conclude that continuous improvement principle in total quality management is a significant strategy for sustainable competitive advantage in manufacturing project delivery.

5. Discussion of Results

The results are discussed here in the context of the research questions.

5.1 Research Question One: What is the level of effect of TQM for sustainable competitive advantage on manufacturing project delivery?

The test of hypothesis one showed that total quality management in manufacturing project is significant for sustainable

competitive advantage. The conclusion was drawn from the result of the F-test (ANOVA) which showed that, F significance = 0.000 is less than 0.05. Hence the null hypothesis (H_{01}) is rejected while alternative hypothesis (H_{A1}) is accepted which states TQM in manufacturing project is significant for sustainable competitive advantage. The conclusion is in agreement with Oakland (1993) as reviewed in the literature. He stated that total quality management is an approach to improving the effectiveness and flexibility of business as a whole. It is essentially a way of organizing and involving the whole organization, every department, every activity, and every single person at every level to ensure sustainable competitive advantage over the organizations competitors.

5.2 Research Question Two: To what extent do genuine quality culture and top management support and commitment relevant to effective delivery of manufacturing project?

The test of hypothesis on this research question showed that genuine quality culture and top management support and commitment are not significant for effective delivery of manufacturing project. The validity of the result was drawn from the statistics test in which the t significant = 0.356 is greater than 0.05. Hence the null hypothesis (H_{02}) was accepted and alternative hypothesis (H_{A3}) was rejected. The H_{02} states that genuine quality culture and top management support and commitment are not significant for effective delivery of manufacturing project. The success of any strategy depends upon the fit between strategy and organizational structure. According to Jabnoun (2005) many organizations failed because of the presence of structures that are incompatible with total quality management. He argued that in a quality culture the managerial imperative is not how to make do, but to do. This is because of the let the workers do it mentality exhibited by top management in organizations. The role of management will need to change, allowing greater freedom or confidence to the employee. Motwani and Kathawala (1994) argued that without the wholehearted commitment by top management, spending time on quality training is useless. Employees look to management to see if the company is really serious about quality training. If management does not commit itself to change then the workers will not do so.

5.3 Research Question Three: To what extent do closer customer relationship, staff training and empowerment relevant to sustainable competitive advantage in manufacturing project delivery?

The research question three can be answered using the test result of hypothesis three. The test of hypothesis three depicted that quality-based custom design product has a significant effect for sustainable competitive advantage on manufacturing project delivery. It can be deduced from here that manufacturing industry cannot achieve quality product based on the opinions and requirement of the consumers if the company does not have a good relationship or a way of interacting with her customers to ascertain the level of satisfaction the customers are deriving from its product. It is only when they interact very well they can be able to design their product based on what the customer want.

Staff training and empowerment has a significant effect for sustainable competitive advantage. This is as a result of the t-test carried out on the X_1 variable in which the t significance of 0.00 is less than 0.05 Significance level. Hence we conclude that staff training and empowerment has a significant effect for sustainable competitive advantage. Staff training and empowerment are part of the overall quality strategy and aims at improving the necessary skills for continuous quality improvement. Powell (1995) in his study concluded that closer customer relationship helps in determining customers' requirements and then meeting those requirements no matter what it takes. If staffs are continuously trained and empowered based on current developments and innovation in technology they will be productive and be able meet the organizational goals. Oakland (1989) points out that quality training must be continuous to meet not only changes in technology, but also changes involving the environment in which an organization operates its structure, and perhaps most important of all the people who work there. From the analysis above we can conclude that closer customer relationship, staff training and empowerment are relevant to a great extent to ensure organizations sustainable competitive advantage in manufacturing project delivery.

5.4 Research Question Four: What is the level of effect of customer defined quality and continuous improvement for sustainable competitive advantage on manufacturing project delivery?

The test result of hypothesis three and four is used to answer the research question four. The test result of hypothesis three depict that quality-based custom design product has a significant effect for sustainable competitive advantage on manufacturing project delivery. This means that customer design quality has a significant effect on organizations strive for sustainable competitive advantage on manufacturing project delivery. The test result of hypothesis four depict that continuous improvement principle in total quality management is a significant strategy for sustainable competitive advantage in manufacturing project delivery. This means that continuous improvement in every aspect of organization has a significant effect for sustainable competitive advantage in manufacturing project delivery. This is in agreement with Mohanty and Lakhe (2002) as stated in literature review. They argued that, continuous improvement is a philosophy that seeks to improve all factors related to the process of converting inputs into outputs on an ongoing basis. It covers equipment, methods, materials, and people. Under continuous improvements, the old adage if it isn't broke, don't fix it, gets transformed into just because it isn't broke doesn't mean it can't be improved.

5.5 Summary of Findings

This research explored extensively Total Quality Management (TQM): a factor of sustainable competitive advantage for effective delivery of manufacturing projects. Based on the results from our analysis of the primary data we summarize our findings as follows:

1. The level of relationship existing between the dependent variable (effective delivery of manufacturing projects) and four explanatory independent variables (X_1 , X_2 , X_3 , and X_4) is strong. This is drawn from the result of our analysis where the value of R-Square is 0.723, which indicate that 72.3% correlations exist between the dependent variable and the four independent variables.
2. Equation 4.1 account for 72.3% of total quality management: a factor of sustainable competitive advantage for effective delivery of manufacturing project when all possible error in estimation is taken into consideration.
3. In testing hypothesis one, the result showed that total quality management in manufacturing project is significant for sustainable competitive advantage by rejecting H_{O1} and accepting H_{A1} .
4. Hypothesis two was tested and the result showed that genuine quality culture and top management support and commitment are not significant for effective delivery of manufacturing project by accepting the null hypothesis H_{O2} and rejecting the alternative hypothesis, H_{A2} .
5. In testing hypothesis three, the result showed that quality-based custom design product has a significant effect for sustainable competitive advantage on manufacturing project delivery. The null hypothesis was rejected and alternative hypothesis accepted.
6. The fourth hypothesis was also tested and the result depict that continuous improvement principle in total quality management is a significant strategy for sustainable competitive advantage in manufacturing project delivery.

5.6 Conclusions

Based on our findings, the following conclusions can be drawn.

1. Total quality management in manufacturing project is significant for sustainable competitive advantage for effective delivery of manufacturing project.
2. Genuine quality culture and top management support and commitment are not significant for effective delivery of manufacturing project.
3. Quality-based custom design product has a significant effect for sustainable competitive advantage on manufacturing project delivery. This is in accordance with William (2002). In his study, he stated that the key to a successful competing is to determine what customers want and then directing effort towards meeting or even exceeding customers' expectation. He said that operations must work with marketing to obtain information on the relative importance of the various items to each major customer or target market.
4. Continuous improvement principle in total quality management is a significant strategy for sustainable competitive advantage for effective delivery of manufacturing project. This is in agreement with the study conducted by Mohanty and Lakhe (2002). The

study ascertain that continuous improvement is a philosophy that seeks to improvement all factors related to the process of converting inputs into output on an ongoing basis.

5. Staff training and empowerment is a significant strategy of sustainable competitive advantage for effective delivery of manufacturing projects.

5.7 Recommendations:

Based on the findings and conclusions of this study, the following recommendations are made:

1. Based on the strong relationships that exist between the variables, manufacturing industries should pursue the issue of Total Quality Management as a factor of sustainable competitive advantage for effective delivery of manufacturing project.
2. For effective delivery of manufacturing projects, manufacturing industries should establish a strong medium through which they interact effectively with their customers and receive feedback on the performance of their product and therefore design subsequent product based on the requirements of the customers. This is because customers are the lifeblood of every business and for organization to be relevant and sustain their competitiveness their product should be quality-based custom design.
3. Top management of manufacturing industries should be committed and lead the total quality management implementation. They should provide the vision of where the company is going with its quality efforts. They must lead in creating a cultural change within the company for effective delivery of manufacturing projects.
4. Manufacturing industries should continuously improve all factors related to the process of converting inputs into output on an ongoing basis.
5. Industrial Engineers and indeed all stakeholders in the Manufacturing sector should as a matter of urgency imbibe Total Quality Management in their service delivery.
6. Federal Government of Nigeria should also begin to see Total Quality Management as very critical to the transformation agenda of the economy and ensuring that Nigeria is among the best 20 economy in the year 2020.

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