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The impact of adopting six sigma to improve total quality management practices applied study in Najaf cement plant

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ABSTRACT

Global and local organizations face many changes and challenges. These challenges have led to the emergence of new concepts in the management of organizations that seek to achieve the goal of survival and continuity in the world of competition by changing their traditional methods that are not commensurate with the challenges faced by organizations. Dealing with the challenges they face and overcoming them to achieve better performance. One of these tools is six sigma. The current study aims to identify the impact of six sigma to improve total quality management, a sample of 64 employees was selected randomly from Najaf cement plant, and the results indicate there is an impact of six sigma on total quality management.

Keywords— *Six sigma, Management support, Relation with customer, Infrastructure, Training and competency, Service improvement, Total quality management*

1. INTRODUCTION

Iraq passed through a long period of negative conditions, imposed by the challenges of wars, the Iraq-Iran war, the first Gulf war and the second, and after 2003 Iraq became suffering from the challenges of terrorism, all these factors directly affected the Iraqi industry sector, Cement industry, so these companies have to look for the necessary means of success for their work. In this context, the concept of Six Sigma and total quality management.

Total quality management has become as one of the most modern and important methods for organizations and has begun to implement them because of the changes and challenges faced by these organizations so that they can survive and continue their work successfully. TQM in quality of goods, quality of services, quality of all activities and processes within the organization to increase the competitiveness of organizations at the local and international level.

Global and local organizations face many changes and challenges. These challenges have led to the emergence of new concepts in the management of organizations that seek to achieve the goal of survival and continuity in the world of competition by changing their traditional methods that are not commensurate with the challenges faced by organizations. Dealing with the challenges they face and overcoming them to achieve better performance.

Some organizations strive to excel in their performance to achieve their goals with the highest possible efficiency and effectiveness. The organizations, whether private or governmental, do not differ. The basis for their action is the successful management of the employability of resources and resources through their use of managerial thought and modern methods to achieve their mission and objectives.

Quality aspects have become one of the fundamental aspects of the current global competitive business (Sadikoglu and Olcay, 2014). Increasing demands of better quality products from customers have put organizations under pressure to provide products that meet the consumer preferences and needs. Business organizations have therefore invested significant resources in quality management practices to improve their operations (Kasemsap, 2015).

Adoption of Six Sigma in the manufacturing of cement proofs to be useful in the production of cement that meet the customers' needs (Madhani et al., 2012). Cement manufacturing is divided into the individual process which is progressive (Kerzner, and Kerzner, 2017). The first process is the acquisition of raw material which includes: limestone, clay, gypsum, and sand then transportation to the factory. The second process is crushing and feeding into pre-heater then mixing with clay, Limestone, and sand (Wang et al., 2016). The third process is heating in the kiln to form clinker and cooling. The final process is the addition of gypsum and finished grinding. Packaging and storage are part of the manufacturing process (Burli et al., 2012). Therefore as the

production of cement proceeds, quality management is a crucial factor measurement of quality is reflected by the Six Sigma outlays.

The impacts of quality management in cement manufacturing are felt to increase sales of cement. Customer satisfaction and general growth in the construction industry (Neyestani, and Juanzon, 2016). Since cement is the primary component of the construction of both bridges and buildings, the quality of the product should be maintained and checked at all times (Rumane, 2016). Six Sigma serves to reduce defects which are inherent in the large-scale production of cement and ensures good quality management practices are upheld in the manufacturing.

Therefore, adoption of Six Sigma is significant in the improvement of quality management in cement manufacturing and management of entire quality in the long run.

Accordingly, this study aims to identify the impact of adopting six sigma to improve total quality management practices in Cement manufacturing.

2. LITERATURE REVIEW

2.1. Six sigma

Six Sigma is a quality control philosophy which is applied in majorly in the manufacturing of homogenous products. Six Sigma is the hierarchy of reducing defects in the production of the homogeneous products in the factory (Garg et al., 2013). At level, six defects per one million units are 3.4 defects, such that for every one million bags of cement only 3 to 4 bags are defective. In management, dimension defects are considered to be the output that does not meet the customers' expectations (Ramachandran, 2016). Motorola Company pioneered six Sigma in 1986. The goal of the six sigma is to identify the weaknesses in the manufacturing process by reducing process cycle time, reducing pollution, reducing costs, increasing customer satisfaction, and subsequently increasing profits.

2.2. Six sigma dimensions

One of the core techniques behind any process improvement in six sigma is the five dimensions of the Six Sigma (Cherrafi et al. 2016). Five dimensions in Six Sigma include define, measure, analyze, improve and control. The approach is an organizational improvement approach that seeks to discover and eliminate causes of errors or deficiencies in business processes by concentrating on process outputs that are important to consumers (Hazen et al. 2014). For this study, we search about the behavioral dimensions that include (Management support, focus on the customer, infrastructure, training and competency, continuous improvement).

2.2.1. Management support: Management support is a general term which means ideas or systems that are embraced to support managers in their day to day management (Conger, 2015). The first review was done by (Cherraf, 2016), on the impacts of six sigma on management support. He stated that any manufacturing company that embraces Six Sigma has been able to have a good flow in its management since the Six Sigma tool enables all the databases to be readily available which makes the production process to be swiftly managed. In their study, they further stated that six sigma is a comprehensive and flexible tool which will, therefore, boost the company in its attempt to effectively manage itself and hence affect the total quality management positively.

2.2.2. Relation with Customer: Relation with the customer in a basic sense means attending to any complain or complement that a customer brings forward and addressing it in a specific manner. (Swink and Brian, 2012), in his research study titled customer focus and quality management states that six sigma has enabled most companies including cement companies in their production and mainly focusing on their customers. He claims that on the adoption of the Six Sigma tool, the cement companies have seen an abundant reduction in customer retention and complains. He also voiced out that the objective of the Six Sigma approach was to obtain and maintain the six standard deviations between the average and the nearest specifications.

2.2.3. Infrastructure: The infrastructure simply means the organizational or physical structures that are needed in the operation of an industry. In his study on the Six Sigma and infrastructure in industries (Cherrafi, 2016) analyzed and brought forward an in-depth insight into Six Sigma and infrastructure in their study of structural organization and modeling. In this case, they pointed out the benefits that this cement industry gains from Six Sigma as a whole. Moreover, the study further brings into the book the similarities and variations of the benefits that the cement industries achieve on adoption of six sigma. They further argued that the analysis that is obtained from these cement industries can as well be used in the other industries notwithstanding the fact that it's expensive to install. He further addresses that in a nutshell this study clearly provides comprehensive and detailed information on the benefits drawn by the cement factories at the inception of the Six Sigma to date.

2.2.4. Training and competency: Training and competency in the other hand entail the act of teaching or developing in oneself or others the skills and knowledge to be used to carry out specific tasks (Ekkelenkamp, 2016). Once one has been trained and able to carry out the job required of him or her, then this is termed as competency. (Kwak and Frank,2016) in their study on the effects of Six Sigma on training and competency, argues that all industries including the cement industry have improved technically since the units of human capital that have been installed on them by using the Six Sigma approach is tangible. They went ahead and explained that the most basic system that any company can use so as to boost its training facilities and the competencies in the current labor market is the Six Sigma.

2.2.5. Improvement: Service improvement, on the other hand, means the processor an ongoing effort to improve service or a product (Bessant et al., 2015). (Bhuiyan et al., 2015) discusses the journey of Six Sigma as well as the journey of the industries in terms of revenue and its stability. They argue that as soon as the cement companies began to embrace the six sigma statistical tool than they started progressing positively. From 2000 onwards any company that used the Six Sigma approach saw a huge increase

in profit (Sreedharan and Raju, 2016). In their study, both Bhuiyan and Baghel pointed out that revenue increased due to the reduction of defects which increased the market share.

2.3. Total Quality Management (TQM)
Total Quality management is an approach in management based on the idea that every member of the management team must at all times maintain high standards of work in any aspect (Akgün, 2014). A customer is someone who purchases your products (Berg and Krishna, 2014). According to (Singh and Rameshwar, 2013) review on total quality management and customer focus, they briefly explained that there are two types of customers and each of them requires attention or focus. The two types of customers are internal and external customers.

Total Quality Management defines a management approach to continuous success that improves the quality of the business outputs by continuously improving organization's internal practices (Taskov and Mitreva, 2015). According to Hill and Fredendall (2016), TQM is a system of management founded on the philosophy that every employee must remain committed to sustaining high working standards in all aspects of the organization's operations. Total quality management is a technique widely used to meet or exceed customer needs and expectations. Total Quality management is a firm-wide management philosophy of continuous improvement of the products quality, services, and processes that focus on customer needs and expectations that enhances customer satisfaction and organizational performance (Fening et al., 2016).

2.4. Total quality management dimensions
According to Nihal Erginel (2017) quality management comprises of eight aspects which include; customer focus, leadership, employee involvement, process approach, continuous improvement, systemic approach and decision-making process based on the most recent evidence (Rumane, 2016). The achievement of the quality output requires a holistic approach in the solution of minor mistakes that compromise the quality of the production. Quality management ranges from leadership to employees, from processing activities to the transportation of the output to the market (Nallusamy, 2016). Therefore quality management calls for regular monitoring and implementation of the steps that reduces mistakes and defects at each stage of production. And the common dimensions are:

2.4.1. Focus on customer: Previous research has shown that customer focus as the fundamental aspect of constant quality improvement within an organization (Keinan and Karugu, 2018). The goal of customer satisfaction in TQM is achieved through attempts by the organization to design and deliver products that satisfy customer needs. According to Dubey, Gunasekaran and Ali (2015), customers dictate the products quality levels thus focusing on customers would a plus towards the organization's performance. Eichorn (2018) observed that the organization listens to its customers, collects information and analyze this information to determine customer needs and expectations.

2.4.2. Leadership: Successful implementation of TQM required management commitment and leadership. Leadership creates and maintains an environment needed for employee engagement to achieve the organization's quality goals (Dubey, and Gunasekaran, 2015). Likewise, leadership creates a trustworthy environment that motivates workers to operate beyond normal efforts thus bringing full organizational change. The quality improvement, therefore, starts with leadership strategies towards quality improvement initiatives.

2.4.3. Employee participation: Employee participation process is designed to empower the teams in the organization to make decisions and solve problems that arise within their area of work (Sadikoglu and Olcay, 2014). The importance of engaging employee in the organization is that it creates a well-established TQM strategy (Mosadeghrad, 2015). The process takes different forms including job sharing, teamwork, empowering employees, training, and development (Gutierrez- et al., 2018). Employee engagement is an important ingredient for achieving quality improvements and better results.

2.4.4. Strategy: Strategic planning is a constant process of assessing the market where the organization operates, evaluates its competitors and finally sets goals and formulate strategies to meet the needs of the current and potential customers (Kantardjieva, 2015). The strategy allows the organization to determine and integrate specific TQM goals and organization's needs into a strategic plan. According to Jimenez et al. (2018), strategic planning is used in planning, developing and implementing approaches that lead to improved customer and employee satisfaction.

2.4.5. Quality improvement: TQM is founded on the idea that overall quality of the products is enhanced through improvement of the quality of the processes that relate direct or indirect to the production of the services (Malik et al., 2018). TQM is a customer-based approach thus the organization needs to be process based too (Obeidat et al. 2016). Improving production process reduce errors, rejects, reduces the production costs and reduces customer complaints (Sadikoglu and Olcay, 2014). Improvement of the processes can be achieved by simplifying the production processes and reducing wastage.

3. MATERIAL AND METHODS

3.1. Instrument
The questionnaire is the statistical method adopted for the purpose of this study. It was designed from two parts. The first part includes the independent variable of (Six Sigma (SS) with five basic dimensions (Management support (MS), Relation with Customer (RC), Infrastructure (INF), Training and competency (TC), Service Improvement (SI)). The second part includes the dependent variable (Total Quality Management (TQM)) with five basic dimensions (Focus on Customer (FC), Leadership (LE), Employee participation (EP), Strategy (ST), and Quality Improvement (QI). The questionnaire was distributed to a sample of employees in Najaf cement factory in Iraq. The distributed questionnaires were 80 questionnaires, and 71 questionnaires were collected, and there are 7 questionnaires was invalid, and the sample size became 64 valid questionnaires.

3.2. Conceptual model

A conceptual model is designed to illustrate causal relationships between variables. The independent variable (Six Sigma) is composed of five basic dimensions (Management support, Relation with Customer, Infrastructure, Training and competency, Service Improvement), the dependent variable (Total Quality Management) is composed of five basic dimensions (Focus on Customer, Leadership, Employee participation, Strategy, Quality Improvement), as shown in Figure 1.

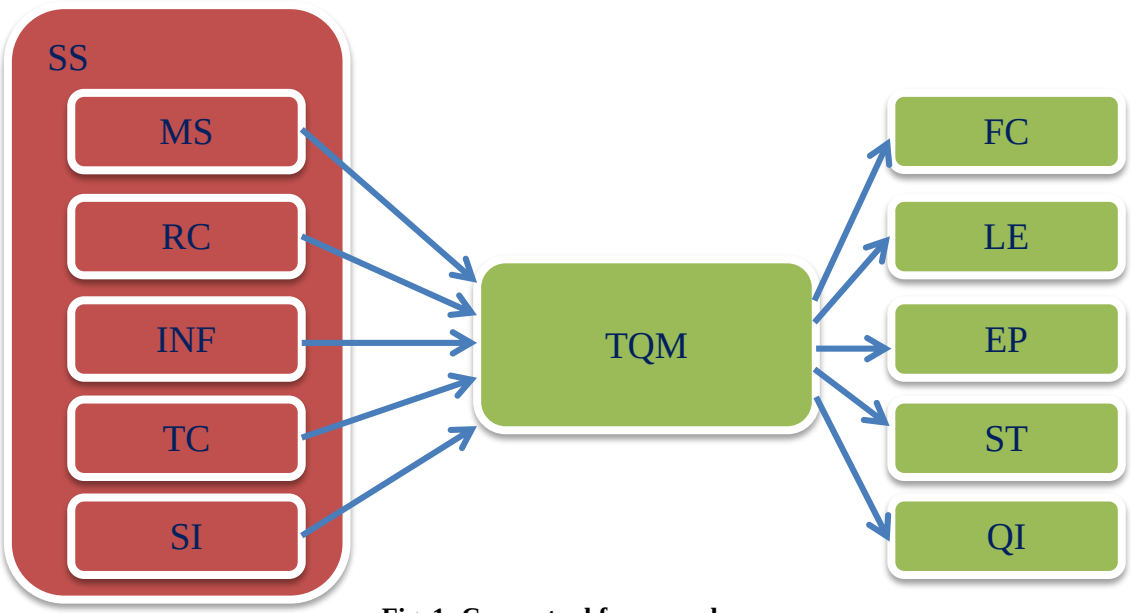

Fig. 1: Conceptual framework

3.3. Validation Tests

The validation tests conducted on the data represented on the excel file is valid. The test focused on validating whether or not the data used was valid, whereby the test used was whole numeric. In essence, the results obtained ascribed that the data was valid because it belonged to the custom range of a minimum of 1 and a maximum of 5, The validity of the questionnaire was evaluated and approved by nine experts in the management and statistics, and reliability was reported at Cronbach alpha, which needs to be above (0.70) (Hadrawi, 2018) accordingly, the result shows accepting values as is shown in table 1.

Table 1: Reliability and validity results

Scale	Factor	Cronbach's alpha
SS	MS	0.813
	RC	0.763
	INF	0.721
	TC	0.771
	SI	0.714
	SS	0.802
TQM	FC	0.734
	LE	0.768
	EP	0.741
	ST	0.812
	QI	0.806
	TQM	0.811
All		0.831

4. FINDINGS

Table 2 shows the correlation between management support as independent variables and Total Quality Management with dimensions (Focus on Customer, Leadership, Employee participation, Strategy, Quality Improvement) as a dependent variable .It is clear that there is a significant correlation between management support and Total Quality Management ,The correlation between the two variables is 0.879 and the correlation is significant based on p-value which is less than 0.05, where the result of general correlation indicates that the correlation is high , and the dimensions focus ON customer, leadership, employee participation, strategy, quality improvement indicate there are significant correlation with management support with (r1=0.744 ,r2=0.827, r3=0.729, r4=0.834, r5=0.719) and all are significant with ($p<0.05$).and the table 3 shows the correlation between Relation with Customer as independent variables and Total Quality Management with dimensions (Focus on Customer, Leadership, Employee participation, Strategy, Quality Improvement) as a dependent variable .It is clear that there is a significant correlation between Relation with Customer and Total Quality Management ,The correlation between the two variables is 0.829 and the correlation is significant based on p-value which is less than 0.05, where the result of general correlation indicates that the correlation is high , and the dimensions focus on customer, leadership, employee participation, strategy, quality improvement indicate there are significant correlation with Relation with Customer with (r1=0.765.r2=0.801,r3=0.656,r4=0.727,r5=0.687) and all are significant with ($p<0.05$). and the table 4 shows the correlation between Infrastructure as independent variables and Total Quality Management with dimensions (Focus on Customer, Leadership, Employee participation, Strategy, Quality Improvement)

as a dependent variable .It is clear that there is a significant correlation between Infrastructure and Total Quality Management ,The correlation between the two variables is 0.820 and the correlation is significant based on p-value which is less than 0.05, where the result of general correlation indicates that the correlation is high , and the dimensions focus on customer, leadership, employee participation, strategy, quality improvement indicate there are significant correlation with Infrastructure with (r1=0.756.r2=0.861,r3=0.624,r4=0.679,r5=0.683) and all are significant with (p<0.05). And the table 5 shows the correlation between Training and competency as independent variables and Total Quality Management with dimensions (Focus on Customer, Leadership, Employee participation, Strategy, Quality Improvement) as a dependent variable .It is clear that there is a significant correlation between Training and competency and Total Quality Management ,The correlation between the two variables is 0.785 and the correlation is significant based on p-value which is less than 0.05, where the result of general correlation indicates that the correlation is high , and the dimensions focus on customer, leadership, employee participation, strategy, quality improvement indicate there are significant correlation with Training and competency with (r1=0.712 , r2=0.712, r3=0.655, r4=0.770, r5=0.587) and all are significant with (p<0.05). and the table 6 shows the correlation between Service Improvement as independent variables and Total Quality Management with dimensions (Focus on Customer, Leadership, Employee participation, Strategy, Quality Improvement) as a dependent variable .It is clear that there is a significant correlation between Service Improvement and Total Quality Management ,The correlation between the two variables is 0.845 and the correlation is significant based on p-value which is less than 0.05, where the result of general correlation indicates that the correlation is high , and the dimensions focus on customer, leadership, employee participation, strategy, quality improvement indicate there are significant correlation with Service Improvement with (r1=0.778, r2=0.805, r3=0.680, r4=0.776, r5=0.665) and all are significant with (p<0.05).

Table 2: Results of Correlation between variables

Iv	r	Sig	Dv
FC	0.744	0.000	MS
LE	0.827	0.000	
EP	0.729	0.000	
ST	0.834	0.000	
QI	0.717	0.000	
TQM	0.879	0.000	

Table 3: Results of correlation between variables

IV	r	sig	DV
FC	0.765	0.000	RC
LE	0.801	0.000	
EP	0.656	0.000	
ST	0.727	0.000	
QI	0.687	0.000	
TQM	0.829	0.000	

Table 4: Results of correlation between variables

IV	r	sig	DV
FC	0.756	0.000	INF
LE	0.861	0.000	
EP	0.624	0.000	
ST	0.679	0.000	
QI	0.683	0.000	
TQM	0.820	0.000	

Table 5: Results of Correlation between variables

IV	r	sig	DV
FC	0.712	0.000	TC
LE	0.712	0.000	
EP	0.655	0.000	
ST	0.770	0.000	
QI	0.587	0.000	
TQM	0.785	0.000	

Table 6: Results of Correlation between variables

IV	r	sig	DV
FC	0.778	0.000	SI
LE	0.805	0.000	
EP	0.680	0.000	
ST	0.776	0.000	
QI	0.665	0.000	
TQM	0.845	0.000	

With regard to the impact of variables Table 7 shows the stepwise multivariate regression analysis for predicting Total Quality Management, as it shown the dimensions Relation with Customer has been excluded from the model due to its weak impact, that conformed through its statistical significant value which is bigger than value allowed (0.05) , it shown that there are three variables were included in the model and regression equation , Management support is the first variable that entered the model and had the most effect on Total Quality Management with (β1=0.796) and determination coefficient (R2=0.773), after this comes the variable Service Improvement with (β1=0.817) and (β5=0.345) and determination coefficient (R2=0.816), and the third model the variable Infrastructure with (β1=0.433) and (β5=0.251) and (β3=0.187) and determination coefficient (R2=0.831), while the fourth model includes Variable Training and competency with (β1=0.385) and (β5=0.143) and (β3=0.199) and (β4=0.170) and determination coefficient (R2=0.842), while the fifth model with Variable Management support, Infrastructure, Training and competency with (β1=0.425) and (β3=0.241) and (β4=0.224) and determination coefficient (R2=0.837), in total model 4 is the best model and there are four variables have shown 0.842 of changes of Total Quality Management. And the regression equation will be as follows:

Total Quality Management = 0.432+ 0.385 Management support + 0.143 Service Improvement+ 0.199 Infrastructure+ 0.170 Training and competency

Table 7: Results of stepwise regression

Model	*IV*	*α*	*β*	R^2	*Sig*	*F*	*SigF*	*DV*
1	*MS*	0.914	0.796	0.773	0.000	210.681	0.000	*TQM*
2	*MS*	0.581	0.517	0.816	0.000	135.213	0.000	
	SI		0.345		0.000			
3	*MS*	0.544	0.433	0.831	0.000	98.189	0.025	
	SI		0.251		0.012			
	INF		0.187		0.025			
4	*MS*	0.432	0.385	0.842	0.000	78.364	0.049	
	SI		0.143		0.193			
	INF		0.199		0.016			
	TC		0.170		0.049			
5	*MS*	0.474	0.425	0.837	0.000	102.660	0.193	
	INF		0.241		0.002			
	TC		0.224		0.004			

5. DISCUSSION

Six Sigma has affected the total quality management practices and impacts greatly on the organization's financial performance. Various scholars and researchers have revealed a significant relationship between total quality management and financial performance especially in profits and productivity (Raja et al. 2016). The results of such studies reveal that quality management practices reduce wastes caused by inefficiencies and poor quality management practices; factors that are handled by six sigma approach. Productivity is the main measure mostly affected by the application of six sigma and TQM (Bhat et al., 2016).

Studies have shown that six sigma has perfected total quality management to achieve continuous improvement through the provision of new structures and approaches (Benner and Tushman, 2015). One important aspect that managers need to understand before adopting six sigma initiatives is the cultural values. According to Al-Refaie and Hanayneh, (2014) the main weakness of the total quality management concept is the selective focus on customer satisfaction. Six Sigma, on the contrary, emphasizes the quality from the perspective of the customer and investor with the main objective of meeting consumer needs profitably. However, six sigma and TQM needs strong incorporation of organization control systems to allow firms to accurately measure and monitor long-term developments as well as financial outcomes using statistical approaches (Antony et al., 2016).

Employee relations, productivity, customer satisfaction, or profitability represents a cause-and-effect relationship between TQM practices and the organization's performance (Gambi et al. 2016). Effective implementation of the six sigma approach leads to enhanced employee relations, better operation processes, improved customer satisfaction, and improved financial performance. Various processes can be performed in a standardized manner especially in areas of customer related outputs such as in payments, processes that use self-service platforms, settlement of inquiries and request approvals. While TQM focuses on the customers Al-Refaie and Hanayneh (2014), Six Sigma focuses on quality improvement and elimination of defects in all organizational processes (Raja et al. 2016). Thus incorporating the concepts of Six Sigma has been known to bring in a holistic approach to quality management.

Fratocchi et al. (2014) noted that the global crisis has led to the collapse of many manufacturing companies who focus only on customer satisfaction without focusing on cultural change. An important aspect has emerged where organizations need to understand their customers in regards to what they think about their products and develop strategies to improve their processes with the main goal of improving customer satisfaction. The significant rise in the application of artificial intelligence tools has left the organization with no option but to implement tech-based systems to improve.

Six Sigma has been applied by many cement manufacturers firms which use the tool to eliminate waste and increase efficiency. Besides, the tool has been used to mitigate the frequency of errors caused by the inconsistent and inefficient production process.

Six Sigma, for instance, prevents the organization from incurring extra costs and old stock. Quality control practice such as quality awards motivates these manufacturing firms to maintain quality standards and processes when carrying out their business inside and outside the organization. These quality awards create a positive image of high-quality products to customers and stakeholders. The Six Sigma approach helps the organization to build confidence and trust in the cement products offered thus leading to higher customer satisfaction.

This study dealt with the impact of six sigma in improving total quality management, especially in view of the increasing challenges facing the industrial sector in Iraq, Where six sigma came to avoid flaws in the traditional systems but also without challenges and differences faced by companies in the actual implementation of the system. The study reached a set of results that contributed to solving the problem of the study and answer its questions and test the validity of its hypotheses. The most important findings of the study can be found based on the responses of the study sample members as follows: the study proved the effectiveness of Management support on the TQM, This result was agreed with previous studies (Cherraf, 2016) stated that any manufacturing company that embraces Six Sigma has been able to have a good flow in its management since the Six Sigma tool enables all the databases to be readily available which makes the production process to be swiftly managed, and the effect of service improvement on the TQM, That refers to the need for the service improvement, and the infrastructure effect directly the TQM, which agreed with (cherrafi, 2016), also the results proved the effect of training and competency on TQM, while the effect of relation with customer was not proved.

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