

The Application of Six Sigma Methodology to Improve Service Quality: A Case Study in an Iraqi Retail Company

Faiza Ibrahim Alghabban^a, Thair Sabri Alghabban^b, ^{a,b}Financial studies, post- Graduate institute for accounting & financial studies, University Bagdad, Iraq,

Recently, service sector companies have begun to implement the Six Sigma technology after its application was initially limited to industrial and semi-industrial companies. Thus, units have started to move towards technologies that can manage their costs strategically and reduce them, while maintaining the quality of service. This includes using Six Sigma technology, as it is considered the cornerstone of an effective application that helps reduce the cost of quality, and offering a product free of error. This, if achieved, will enhance the competitiveness of units, in terms of non-excessive operational cycle times, inefficient operations, and the high cost of service delivery. The research applies Six Sigma to services by combining analysis and an understanding of Six Sigma intention to maintain cost, reduce the average cost per unit of activity, and achieve customer satisfaction by providing a fault-free and flawless product that enhances competitiveness. To achieve this, the units require the adoption of Six Sigma technology, as the basis for the effective implementation of quality management, which helps them reduce the cost of their services under the challenges of globalisation, and information technology. Furthermore, trending towards the quality of services, as a means to win the customer's satisfaction, and meet their requirements to achieve a competitive advantage, ensuring a market share to maximise profits, and survival.

Keywords: *Six sigma, Customer services quality, DMAIC.*

Introduction

The Six Sigma technology is rooted to the nineteen-eighties, when Bill Smith joined the Motorola company and found a way to reduce defects by no more than 3.4 defects per million opportunity. This method saved five per cent of production costs that were previously spent on repairing faulty units and provided at \$2.2 billion dollars. The technology is based on the direct correlation between the number of defects in production, operational costs, and customer satisfaction. In this new technique, individuals prepare to work in a team to achieve the goal in a systematic approach, solving operations problems by reducing contrast and errors in performance after improvement (Kosina, 2013: 17). It is also a way to improve processes based upon customers' feedback (Garrison et al., 2010: 11). Moreover, it is a new technique that produces from its application a reduction in operational deviation (Manville et al., 2012). From the above, we concluded that the Six Sigma is a modern technology to solve problems that units face, which reduces costs, and raises the quality level. It depends on continuous improvement through steps which are based on real data from certain sources, and it is based on the correct knowledge of customers' requirements, where it prioritises them and tries to achieve this satisfaction by providing products with a minimum amount of defects, and low costs. The technology aims to achieve 3.4 defects per million opportunity, which is a dimension strategic and requires cooperation from the highest to the lowest level for the success of its work. The increase in the Six Sigma level will lead to a small percentage of error and increase in the number of units that achieve the return and ratio of void in the Six Sigma level, reaching less than one. The table below shows the relationship between the Sigma levels, up to the sixth level, and the cost and yield ratio defects per million opportunity. It is noted that the high level of Sigma reduces the cost of losses and transforms from very influential ratios exceeding 40 per cent in the second level to reach one per cent in the sixth level.

Table 1: The Relationship Between the Six Sigma Level, Defects, Cost, and Yield

Six Sigma Level	DPMO	Cost ratio %	Process yield %
1	691,500	Less than 40%	30.85
2	308,300	More than 40%	69.15
3	67,000	From 40–25%	93.32
4	6,220	From 25–15%	99.38
5	233	From 15–5%	99.977
6	3.4	1%	99.99966

The Principles of the Six Sigma Technique

1. Focussing on the customers' satisfaction by studying their requirements, expectations, and desires.
2. Relies on facts to clarify the criteria that will be used to evaluate the performance.
3. Operations are the axis of success in either design, improving performance or customer satisfaction.
4. Effective management is based on prior planning to address problems and focus on prevention.
5. Unlimited cooperation within the unit to break the barriers and improve teamwork performance.
6. Continuous improvement to reduce deviations, maintain quality, and increase productivity by adopting new methods.
7. Preventing failure before it occurs, and then inspecting it for detection and treatment.

Sigma's Criteria Identifies Several Important Roles for Successful Implementation ^[12]

1. Executive leadership includes the Executive Officer, and other members of the senior management. It is responsible for forming an operational vision of the Sigma standards, and other actors also have the freedom to discover the necessary resources and new ideas to achieve improvements.
2. The heroes are responsible for implementing the Sigma standards throughout the company in an integrated manner and play the role of mentor or teacher to those carrying the black belt.
3. The distinctive black belts, the heroes, serve as internal trainers of the Sigma standard and devote their time to it. They also help champions and guide black and green belts. Therefore, they spend their time ensuring consistent implementation of Sigma's standards across different functions and departments.
4. The black belts work under the distinctive black belts to apply the specific Sigma standard methodology to projects. First, they focus on Sigma standards for project implementation, while the heroes and distinctive black belts focus on identifying the projects and functions of the Sigma standards.
5. The green belts are employees who are responsible for implementing the Sigma standards, and along with their other functional responsibilities, they work under the direction of the black belts.

The Benefits of Applying the Six Sigma Technique

One of the primary reasons that led units to apply this technology is its benefits (Al Yamor, 2010: 265), which are:

1. Reducing costs, either in failure or in unit production or by avoiding taxes.
2. Achieving high levels of revenue, market value of its shares, and rate of yield on investment.
3. Develop teams for unit comprehensive improvement.
4. Transform organisational culture from error-fighting style to error prevention style.
5. Remove unnecessary steps from operations.
6. Reduce the cost of quality that the unit tolerates.
7. Raising awareness of the techniques' importance, which is used in problem solving and achieve employee satisfaction.
8. Management decisions are more effective because they depend upon the data and facts, rather than assumptions.

Guidelines to Applying Six Sigma Technology

The Methods of Applying the Six Sigma Technique

The Sigma's project criteria follow two approaches which are inspired by Deming's series of plan, work, examine, and act. The technique consists of five stages, known commonly as the abbreviations DMAIC and DMADV (Horngren et al., 2012).

1. Define, Measure, Analyse, Improve, and Control (DMAIC): is used for projects that aim to improve existing business processes (Horngren et al., 2012).
2. Define, Measure, Analyse, Design, and Verify (DMADV): is used for projects that aim to create new products or process designs (Horngren et al., 2012).

The five stages of the DMAIC project methodology are:

1. Select a high level of project objectives and the current process.
2. Measuring basic aspects of the current process and collecting relevant data.
3. Analyse data to check the cause and effect, and determine the relationships between them, and attempting to confirm them.
4. Process improvement based on data analysis by using methods such as design experiments.
5. Control to ensure that any deviation from the target is corrected before it leads to defects. Provide initial testing of the system to verify operational capabilities and establish a monitoring mechanism for continuous monitoring of the process.

The five stages of the DMADV project methodology are:

1. Determination design objectives that are consistent with customers' needs and organisation of strategic projects.
2. Measuring and determining the critical characteristics of quality, product capabilities, production process capabilities, and risks.
3. Analysing to develop and design alternatives, create designs, and then evaluate their ability in order to choose the best.
4. Designing details, identifying the optimum, and make plans to verify it. This stage may require simulation.
5. Checking the design and creating experiments, implement the production process, and deliver it to the decision-makers.

The DMADV methodology is also known as 'DFSS', an abbreviation for "design for Sigma standards" (Horngren et al., 2012)

Methodology

The research problem has been clarified in terms of the difficulties that the Iraqi retail company was facing when it wanted to obtain a large market for its various products. This was due to its high costs, the customers' dissatisfaction, and their tendency towards alternative products, which led to the loss of their market share. The research purpose is to explain the course of the Six Sigma (6σ) technology in determining and eliminating the causes of defects, and to reduce them, and to lower the variation in the processes of manufacturing their service products. This is undertaken in an effort to reduce their costs and enhance their profits and competitiveness in the labour market, while maintaining quality. The research hypothesis begins when the Six Sigma (6σ) is used to manage costs in the retail sector, which leads to its reduction while maintaining quality, increasing customer satisfaction, gaining loyalty, and increasing profits. The importance of the research is to gain the company manager's attention by using contemporary technologies, including the Six Sigma (6σ) in the Iraqi business environment, as it has an impact in reducing cost, and improving profitability, and competitive performance. The researcher relied upon the company's data for the years 2015, and 2016, which were affected by a decline in oil prices. Added benefit was obtained from the previous technical studies of the services sector, and the challenges of applying its methodology to improve the quality of service. Perhaps, the most important studies of which were: Biolos (2002), Antony (2004), Patton (2005), Hensley and Dobie (2005), Pei-Shih (2006), Antony (2006), Chakraborty and Tan (2007), Antony et al. (2007), Tjahjono (2010), and Ray (2010).

In the study of Kumar et al. (2008) they outlined to the Six Sigma (6σ) critics that technology is not innovation, its methodology is not limited to statistics alone, it is a good technique for manufacturing and service delivery, and not only for large organisations, but should be

extended to include small and medium-sized units. They differ from TQM, and do not require strong infrastructure and intensive training, and are ultimately cost-effective. Therefore, the Six Sigma (6σ) can be applied to the service sector, and its role will not be limited if there is an understanding of the nature of services and how customers judge the quality of services. There are considerations that can be taken when applying the technology to achieve the most benefit. Perhaps, the most important one is to put the customer first, and identify how to influence him, meet his wishes and expectations, and gain his satisfaction. Moreover, to search for the main causes that made the customer cease to deal with the unit; know the main cause of problems experienced by the unit; determine what is considered a defect in the service and how it will be measured; and conduct a comparison between the capabilities of the unit before and after the implementation of the Six Sigma. In addition, identify the considered risks in the unit, determine the costs and benefits associated with each part of the unit, and finally, clearly define the responsibilities of everyone in the unit. All of these are important considerations when implementing the Six Sigma (6σ) in any unit. On the other hand, it may be difficult to control and measure the Six Sigma in the service industry due to difficulties arising from various subprocesses. The study focussed on what is meant by the Six Sigma entry, what are the techniques of it, the key factors that support applying it, and what are the barriers that impede the application of the Six Sigma. The study pointed to the importance of implementing the Six Sigma in service organisations, as a result of the benefits that will be achieved through the systematic application of Sigma. A Six Sigma study gave a model to select good projects that have an impact upon customer satisfaction. The study also referred to the factors influencing the success of Six Sigma projects, which are supported by senior management. The results concluded that the implementation of the Six Sigma has reduced errors, improved product and process, and it also has a significant impact upon increasing a company's market share and profitability, and in reducing the cost of quality. In addition, the results indicated that the role of the Six Sigma was inefficient in identifying the total cost, manufacturing, and production efficiencies.

What distinguishes the current study from previous studies, is that previous studies were related to the Six Sigma effect in reducing the cost of poor quality, and in terms of statistical objectives, treatments, and methods and tools that were used to select samples, and collect private data. In terms of the objectives, they were varied. Several of them were intended to identify the effects of the Six Sigma applications upon reducing, while others dealt with problems that stood in the way of performance, as described in the study of Al Yamours. Furthermore, this study is different from previous studies, as it has examined the requirement's availability for the Six Sigma application, and its effect in reducing the cost of poor quality. In addition, the researcher wished to demonstrate the implementation of the Six Sigma method, and the contribution in reducing poor quality cost. The study is characterised as a rare one because of a lack of studies in this area. Therefore, this study is complementary to the lack of studies in Iraq, and it has opened the way for subsequent studies. Through the

previous studies, the researcher benefited from building an idea of the study, as the Six Sigma has been identified in reducing poor quality cost. It was necessary to introduce new and modern methods suited for the changing environment in Iraq, which helps to identify those methods. The researcher reported from the foreign studies that addressed the Six Sigma requirements, and showed how effective it is in reducing poor quality cost.

Proposed Approach

As mentioned previously, the application of the Six Sigma is mainly limited to the retail services sector. To some extent, its application can be found in call centres. The main focus of services, as well as the Six Sigma, is to improve processes. The process control variables' characteristics are an important aspect to improving processes. Along with the control variables, the outcome due to the application of the Six Sigma is also a major aspect. The case study done here focusses on the above mentioned two aspects of key measurable characteristics (CTQs), and key performance indicators (KPIs). A summary of KPIs from other services, where the Six Sigma is already applied, is presented to understand the requirements for the different types of services

Case Study

The case study was conducted in one of the retail sector companies for clothing, shoes, and bags because of the opportunity to address the problem of competition. It is exposed to its products by the products of the similar units that use the SAP system which is specialised in clothing, shoes and accessories. It aims to reduce the cost of its products, and to achieve excellence towards competitors to increase its market share by using technology in the retail sector. The application of this technology went through five stages:

1. The first stage is to determine where and how to start the process of reducing costs by using the Six Sigma in the company. Wherein, a work team was formed to diagnose problems and find ways to solve them, to be able to reduce costs, and agreed to form a business group working in two directions. The first is that each person work within his specialty, identify the problems, and propose solutions. The second direction is that the members of the group work together to discuss the problems and propose solutions to find the most appropriate alternative.
2. In the second stage, they agreed to invite those whose attendance was required to hear their opinions about the problems, even if they were outside the team in the first stage. The decisions are made by the majority, and the responsibility for following up the implementation of decisions shall be the members' job, according to the respective section.

3. The steps that were used to solve the problems will be documented in a working paper, and the team will follow them continuously.
4. The group work should be phased out to improve work, and it should not stop when the current problems are resolved.
5. Identifying problems and analysing their causes, especially selling products at high prices, and high costs that affect the company's ability to control prices. It was found that a few causes will lead to bigger problems, either directly or indirectly, and thus it will achieve Pareto's base (80–20). The principle agrees that 20 per cent of the factors that are considered as inputs, lead to the occurrence of 80 per cent of the problems. These are considered as outputs, and the remaining 80 per cent leads to the remaining 20 per cent of the company's problems. The increase in process that the company adopts is the main problem that leads to sales decline, profits, market share, losing the competition, and goods overstocking, which will lead to further damages. Thus, reducing their market value and loss of competitiveness. Moreover, this would make the company sustain a limited capacity to reduce the product's prices, while maintaining the desired margin of profit, especially if the company wanted to maintain the desire to achieve price superiority.

The following table shows the products, models, and the quantities required to purchase them, in each chapter.

Table 2: Quantity of products to be purchased by the company in each chapter and number of models

Product Type	Quantity/Unit	Prototype Quantity
Safety Shoe 4–6	180	2
Safety Shoe	240	2
Youth Leather Shoe	2,100	42
Sports Shoe	2,100	48
Various Shirt Models	720	12
T-Shirts	2,400	20
Jeans Trouser	720	12
Linen Trouser	360	4
Suitcase	240	6
Backpack	540	12
Accessories	400	20
Total	10,000	180

Source: The researcher has relayed on the company's data

The Company's Previous Pricing Method

The company uses a pricing method based on multiplying the total purchasing cost of each unit from the product, and until it is delivered to the company's warehouses several times or specifically, 2.25 times. This percentage is derived from the pricing operator experience. The following table shows how the company tracks the price of its products.

Table 3: Pricing of the company for the products that deal with

Product Type	Purchase Cost Rate	How Often	Product Average Price
Safety Shoe 4–6	\$70	2.25	\$160
Safety Shoe	\$60	2.25	\$135
Youth Leather Shoe	\$43	2.25	\$97
Sports Shoe	\$41	2.25	\$92
Various Shirt Models	\$26	2.25	\$58
T-Shirts	\$19	2.25	\$43
Jeans Trouser	\$36	2.25	\$81
Linen Trouser	\$28	2.25	\$63
Suitcase	\$67	2.25	\$150
Backpack	\$27	2.25	\$60
Accessories	\$20	2.25	\$45

Source: the researcher has relayed on company's data.

The purchase cost includes the product price + the cost of the mark of loyalty + shipping costs + customs taxes + any other costs, until they reach the company's stores.

The loyalty cost is an extra cost paid by the company to the brand owners, and is added to the product price, and the purchase cost was used due to the model's multiplicity. Since each product in Table 4 is presented on up to 48 models, and there is a difference in the price between each model, the price rate was taken from the samples for each product. However, as noted in the previous table, the company's pricing method was the same across all products since pricing is not followed by market-based methods. Under this method of pricing, the company achieved a margin of up to 16 per cent of goods value at the selling price. The percentage was reached according to the following equations:

$$\text{Profit margin} = \text{goods value at selling price} - \text{total cost of goods}$$

$$\text{Profit margin ratio} = \text{profit margin} / \text{goods value at selling price}$$

Before the technology application phase, it is necessary to present the costs to the company through the following table.

Table 4: Current costs of the company per month

Details	Amount
Renting sales outlets	\$52,000
Salaries, wages and bonuses	\$28,000
Fuel	\$450
Loading and Transportation	\$280
Phone Calls	\$400
International Network Services Subscription	\$1,500
Maintenance Costs	\$3,000
Bank Services	\$900
Services Expenditures	\$3,500
Supplies and Stationery	\$225
Various Expenditures	\$120
Legal Fees and Expenditures	\$650
Travel and Dispatch Expenditures	\$1,000
Hospitality Expenditures	\$180
Damage Costs	\$1,600
Exhaustion Expenditures	\$750
Total	\$94,555

Source: The researcher has relayed on company's data.

Table 5 shows that rent and wages have the highest values, so priority should be given to reduce these two elements and to focus upon them. To know the current total cost of each product, see the following Table 5.

Table 5: The product's current total cost

Product Type	Purchase Cost Rate	Other Expenditures Rate (2)	Current Total Cost Rate (2+1)
Safety Shoe 4-6	\$70	\$58	\$128
Safety Shoe	\$60	\$49.70	\$109.70
Youth Leather Shoe	\$43	\$35.60	\$78.60
Sports Shoe	\$41	\$34	\$75
Various Shirt Models	\$26	\$21.50	\$47.50
T-Shirts	\$19	\$15.75	\$34.75
Jeans Trouser	\$36	\$29.80	\$65.80

Linen Trouser	\$28	\$23.20	\$51.20
Suitcase	\$67	\$55.50	\$122.50
Backpack	\$27	\$22.40	\$49.40
Accessories	\$20	\$16.60	\$36.60

Source: the researcher has relayed on company's data.

The paragraph weight was used based on the total purchase cost of the purchased products in the distribution of other costs. The company used traditional pricing methods, and its decisions represented the sector's director point of view. Therefore, the company must undertake procedures to change the work department to suit the business environment requirements, and contemporary management methods, such as brainstorming, making the associate do more than one job at the same time, as long as there is no conflict between them. Furthermore, the associate should have enough time to achieve his tasks, and that will profit the company to save time and costs. In addition, to opening direct communication channels that deliver the customers' voice to the commercial section, and without a mediator. For this purpose, a pre-paid website has been created on social media that sends subscriptions invitations to customers, to give them the ability to see products and outlets through which they can obtain products. It also surveys the customers' opinions about the products that you deal with, whether the products exist currently in stores or are new models you want to deal with. This also gives customers the opportunity to complain about any problems that they may face, regarding either products or outlets' employees, allowing the company to obtain benefit from that information to correct the situation to achieve the customers' satisfaction. The availability of after-sale services contributes to a customer's trust and satisfaction, and reliance on market studies, as well as analysing historical information. Through implementing a price-fixing policy by knowing the prices of competing products, and the market ability to accept prices, the gradual reduction policy towards unsold products in a certain period facilitates the disposal process, and the reduction rate will increase as seasons and fashion come to an end.

The company has suffered from numerous errors, including the selection of models that are not suitable for fashion trends in the local market, pricing errors that do not accommodate market absorption, and errors in purchasing inappropriate quantities. The Enterprise Resource Planning System (SAP ERP) had the credit, as it provided the required data quickly. The following table shows the error rate and its number in units, in each chapter before the procedures.

Table 6: Errors of commercial section by number and proportional to total units in each chapter before procedures

Fault Type	Number of Units	Fault Percentage of the Total Units
Type Selection	1,260	12.6%
Price	2,304	23.04%
Inappropriate quantities	432	4.32%
Total	3,996	39.96%

Source: the researcher has relayed on company's data.

After knowing the types of errors, numbers, and percentages of the commercial section, multiplication of those ratios in 1,000,000 was performed to use the output to extract the diffraction level, as indicated in the following table, which shows the current levels of returns in the commercial section.

Table 7: Current Sigma levels in commercial section

Fault Type	Faults Per Million Units	Current Diffraction Level
Type Selection	126,000	2.7
Price	230,400	2.3
Inappropriate quantities	43,200	3.3

Source: the researcher has relayed on company's data and the attached table.

The previous procedures contributed in reducing the errors that the section was going through by tangible proportions. In addition, to reducing the quantity of goods that accumulate in the stores from each season, as well as the collective selection process by the commercial section members with participation of the outlets' representatives, and with the help of suggestions received from customers through social media about the right choice of products required in the market. This has also contributed to adopting new price policies and employees training. The following table shows the ratios and the new units' numbers.

Table 8: Commercial section errors in numbers and its percentage to the total units in each chapter after the procedures

Fault Type	Products No.	Fault Percentage of the Total products
Type Selection	312	3.12%
Price	456	4.56%
Inappropriate quantities	192	1.92%

Total	960	9.6%
-------	-----	------

Source: the researcher has relayed on company's data and the attached table.

Furthermore, the following table represents the new Sigma levels based on the error numbers and their new percentages.

Table 9: New Sigma levels of commercial section

Fault Type	Faults Per Million	New Diffraction Level
Type Selection	31,200	3.4
Price	45,600	3.2
Inappropriate quantities	19,200	3.6

Source: The researcher has relayed on company's data and the attached table.

Reducing costs by reducing marketing outlets renting cost

The company needs outlets to market its products, therefore, they need shops where these products are exposed, and are easily accessible by the target customers. Based on this, the company negotiated with commercial malls' managements, in which the company owns shops in order to obtain a reduction in rent and services prices. The company has succeeded, as malls' managements have understood this endeavour, and that process has made the company receive discounts, shown in the following table.

Table 10: Monthly reduction in rent expenses

Method	Monthly Reduced Amount
Reducing rent directly	\$2,000
Converting rent to selling ratio	\$1,600
Mixing selling outlets	\$6,000
Closing outlets	\$5,000
Total	\$14,600

Source: the researcher has relayed on company's data.

The closure and merge of sales outlets resulted in loss of ten employees, and at a monthly rate of \$400 to provide \$3,600 per month (NO. 1Table 16). This led to reduce communications expenses by \$180 per month, international network services by \$225 per month, service charges by \$800 per month, and other expenses by \$200 per month.

Reducing Costs through Managing Human Resources

The resources department have prepared a study about human resources working in the company, whereby the required jobs were set, and the job descriptions of each work unit was determined with certification of their respective technical qualifications. As a result, some surplus and non-qualified employees were dismissed. It also provided training to raise staff efficiency and provided a base for employees' evaluation. Due to management's efforts, the below reductions have been made in the company's salaries cost. The following table shows the total reduction in the component wage.

Table 11: Monthly reduction in component wage

No.	Reduction type	Monthly Reduced Amount
1	Reduction made by merging and closing outlets	\$3,600
2	Reducing sales staff fees	\$1,600
3	Mixing selling outlets	\$5,00
4	Closing outlets	\$5,00
	Total	\$6,200

Source: the researcher has relayed on company's data.

Reducing costs by cooperating with manufacturers

This is considered as the most difficult, as there is a confidentiality to the company's products, as it comes from brands manufacturers who depend on a fixed price for all agents around the world. The company has chosen a certain practice, wherein the agent is given a special discount or an exclusiveness to the country in which he works. The company succeeded in obtaining a reduction of three per cent of the total purchase cost, and the following table shows the cost of buying bags before and after the reduction.

Table 12: The cost of purchasing bags product before and after the reduction

Product type	Purchase cost rate	Reduction ratio	New purchase cost rate
Suit case	\$67	3%	\$65
Backpack	\$27	3%	\$26.20

Source: the researcher has relayed on company's data.

Reducing Costs by Logistics Management

The cost of shipping products from the factories to the company's stores is part of the total purchase costs. It was found that there was a rise in the costs caused by the partial shipping of

products, and the coordination of product shipment timing from factories. The procedures resulted in a reduction by 23 per cent in shipping costs, and 60 per cent in customs taxation expenses, as well as a decrease in shoes purchasing costs by four per cent.

Table 13: Shoes cost before and after the reduction of shipping and customs taxation costs

Product type	Purchase cost rate	Reduction ratio	New purchase cost rate
Safety Shoe 4–6	\$70	4%	\$67.20
Safety Shoe	\$60	4%	\$57.60
Youth Leather Shoe	\$43	4%	\$41.30
Sports Shoe	\$41	4%	\$39.40

Source: the researcher has relayed on company's data.

Reducing Costs by Stores Managing

As a result of changing the warehouses management with a new management, this led to the clarity of tasks, distributing available time, and employees were on-task. By reducing the time and effort of the receiving processes, the products were distributed in a timely manner to increase the opportunity to sell products, thus reducing missing opportunities costs. These producers have led to a decrease in the average number of damaged units per month and their costs.

Table 14: Damaged unit's costs in numbers

Damage location	Unit numbers	Cost
Warehouses	18	\$450
Internal Transport	18	\$450
Selling Outlets	28	\$700
Total	64	\$1,600

Source: the researcher has relayed on company's data.

In addition, a reduction was achieved in the damage costs, which the company had suffered from, by 50 per cent compared to the previous situation. The following table shows the new number and the damage costs of the products after the reduction.

Table 15: Number of damaged products and their costs after reduction

Damage location	Unit numbers	Cost
Warehouses	5	\$125
Internal Transport	18	\$450

Selling Outlets	12	\$300
Total	35	\$875

Source: The researcher has relayed on data from Financial Links

The following table represents a comparison between the damaged product numbers before and after the reduction.

Table 16: Comparison between damaged product numbers before and after the reduction

Damage location	Before reduction	After reduction	Difference
Warehouses	18	5	13
Internal Transport	18	18	0
Selling Outlets	28	12	16
Total	64	35	29

Source: the researcher has relayed on data from Financial Links

The following table has been used to understand the Sigma level before and after the procedures to reduce the product damage:

Table 17: Sigma level before and after the reduction damage procedures

Timing	Defects per million opportunity	Sigma level
Before procedures	6,400	4
After procedures	3,500	4.2

Source: Relying on Financial Links data and sigma levels table

It is observed that the change in Sigma ratio was slight and did not meet the company's ambition level, as well as the errors, which were also reduced by high rates. This led to transition in higher Sigma levels, but did not reach the Six Sigma level. However, the team were satisfied with the achieved results. In order to understand the company's costs after the reduction procedures were made, see the following Table 18.

Table 18: Company's monthly costs comparison before and after the reduction

Details	Before reduction	After reduction	Change Amount
Renting sales outlets	\$52,000	\$40,400	\$14,600
Salaries, wages & bonuses	\$28,000	\$21,800	\$6,200
Fuel	\$450	\$450	-
Carrying & transportation	\$280	\$280	-

Phone call	\$400	\$220	\$180
Subscription of international network services	\$1,500	\$1,275	\$225
Maintenance expenses	\$3,000	\$2,400	\$600
Banking services	\$900	\$900	-
Service expenses	\$3,500	\$2,300	\$1,200
Supplies and needs	\$225	\$175	\$50
Other expenses	\$120	\$120	-
Fees and legal expenses	\$650	\$650	-
Travel and dispatch expenses	\$1,000	\$1,000	-
Hospitality expenses	\$180	\$180	-
Damage expenses	\$1,600	\$875	\$725
Exhaustion expenses	\$750	\$900	\$150
Total	\$94,555	\$70,925	\$23,630

Source: the researcher has relayed on company's data.

From the above table, it is noted that the company has succeeded in reducing its monthly costs by 25 per cent, which was believed to be a good result for the cost reduction efforts. After obtaining the total cost after reduction, it was redistributed for the purpose of calculating the unit cost of products, as a result of the reduction procedures.

Table 19: Total products cost after reduction

Product Type	Purchase cost average (1)	Average of Other costs after reduction (2)	Total costs after reduction (1 + 2)
Safety shoe 4–6	\$67.20	\$42.80	\$110
Safety shoe	\$57.60	\$36.75	\$94.35
Youth leather shoes	\$41.30	\$26.35	\$67.65
Sport shoe	\$39.40	\$25.15	\$64.55
Different shirt models	\$26	\$16.60	\$42.60
T-shirt	\$19	\$12.10	\$31.10
Jeans Trousers	\$36	\$23	\$59
Linen Trousers	\$28	\$17.90	\$45.90
Suitcase	\$65	\$41.50	\$106.50
Backpack	\$26.20	\$16.70	\$42.90

Accessories	\$20	\$12.75	\$32.75
-------------	------	---------	---------

Source: the researcher has relayed on company's data.

After understanding the value of the total products costs after reduction, it is appropriate to compare them with the original costs, and then extract the difference between them to know the difference and its importance. Therefore, the following table was used:

Table 10: Comparison of total products costs before and after reduction

Product Type	Costs average before reduction	Costs average after reduction	Reduction amount
Safety shoe 4–6	\$128	\$110	\$18
Safety shoe	\$109.70	\$94.35	\$15.35
Youth leather shoes	\$78.60	\$67.65	\$10.95
Sport shoe	\$75	\$64.55	\$10.45
Different shirt models	\$47.50	\$42.60	\$4.90
T-shirt	\$34.75	\$31.10	\$3.65
Jeans trousers	\$65.80	\$59	\$6.80
Linen trousers	\$51.20	\$45.90	\$5.30
Suitcase	\$122.50	\$106.50	\$16
Backpack	\$49.40	\$42.90	\$6.50
Accessories	\$36.60	\$32.75	\$3.85

Source: The researcher has relayed on company's data.

The team believes that the achieved results in cost reduction are good when compared to the experience's age and its modernity for them. The team wishes to maintain the achieved costs level, at this stage. For this purpose, the team has decided to complete a comprehensive review of the cost provisions at the end of each month. This is undertaken in order to determine whether there is a deviation from the rates that were achieved, and to identify the causes and remedies to prevent their impact on the company's results. In addition, to improve work by implementing the developments and changes that occur in a business environment.

Conclusion

This paper presents the Six Sigma applications in the field of services, in order to improve its quality. The Six Sigma is a philosophy that also focusses on improving processes. Therefore, the Six Sigma, if applied properly, can be useful for services. This study focusses on the



application aspect of the Six Sigma in a wide range of services, and based on identification of KPIs for different types of service operations. A case study is conducted in call centre services to identify, analyse, and compare CTQs and key performance indicators with other types of services available in literature. This study will be useful for both practitioners and researchers. The company depends on the traditional cost systems to manage their cost and forgetting the changes in cost management techniques in the modern business environment, which will prevent reaching the Six Sigma level. This is because the company employees resist the change, as it damages their interests, and the lack of interest in time, as it is one of the main factors of success in operations. In addition, to the lack of physical, human, and technological factors required to apply the Six Sigma technology, which is appropriate to the nature of the economic activity of this company, and its specificities that depend on seasonal fashion. Under the conclusion above, the recommendations will be based on adopting towards the application of modern cost management techniques, which will control and reduce costs while also maintaining quality. This will position the customer as the centre of its work in reducing costs processes, and achieve a competitive advantage that contributes in increasing its market share through applying the Six Sigma technology, as long as it keeps achieving results in reducing costs, errors, and damage.



REFERENCE

- Bajwa, G., Sharma, H. and Hsarma, P., (2016). Implementation of Six Sigma in India. The Catalyst-Journal of Management, Vol. 1, Issue 2, PP: 56-64.
- Carlson, C., (2014). Understanding and Applying the Fundamentals of FMEAs. 2014 Annual Reliability and Maintainability Symposium, Colorado, USA
- Chase, R., Aquilano, N. and Jacobs, F., (1995). Operations Management for Competitive Advantage. McGraw-Hill, New York, USA.
- Cooper, R., and Chew, B. (1996). Control Tomorrow's Costs through Today's Design. Harvard Business Review, US, Vol. 74, No. 1, PP: 88-97.
- Drury, C., (2008). Management and Cost Accounting. 7th, Ed., USA.
- Garrison, R., Noreen, E. and Brewer, P., (2010). Managerial Accounting. 11th Ed., McGraw-Hill, New York, USA.
- Garrison, R.H. & Noreen, E.W. (2008). Managerial Accounting. 11th Ed., McGraw-Hill, Singapore.
- Grant, R., (202). Contemporary Strategy Analysis: Concepts, Techniques, Applications" 4th Ed., Blackwell, USA.
- Hilton, R., (2008). Managerial Accounting: Creating Value in A Dynamic Business Environment. 17th Ed. The McGraw-Hill Companies, Inc. USA.
- Horngren, C., Datar, S., Foster, G. Rajain, M., and Ittner, c., (2009). Cost Accounting A Managerial Emphasis. 13th Ed., Pearson Education, Inc. New Jersey, USA.
- Horngren, C., Datar, S., Foster, G., and Rajain, M., (2012). Cost Accounting A Managerial Emphasis" 14th Ed, Pearson Prentice Hill Inc. USA.
- IFAC, (2008). Costing to Drive Organizational Performance. International federation of accountants, International Good Practice Guidance.
- Jackson, S., Sawyers, R., and Jenkins, J., (2009). Managerial Counting: A Focus on Decision Making. 5th Ed., Ohio, South-western: Thomson.
- Khurshid, K., (2012). Implementation of Six Sigma in Australian Manufacturing Small and Medium Enterprises. Submitted in fulfilment of the requirements for the degree of Masters of Commerce at Deakin University.



- Kosina, J., (2013). The Process to Estimate Economical Benefits of Six Sigma Projects" Quality innovation prosperity XVII/1, PP: 16-27.
- Lagrosen, Y., Chebl, R., and Tuessta, M., (2011). Organizational Learning and Six Sigma Deployment Readiness Evaluation (A Case Study). International journal of lean six sigma, Vol. 2, No.1, PP: 23-40.
- Manville, G., Greathbanks, R., Krishnasamy, R., and Parker, D., (2012). Strategy Analysis: Concepts, Techniques. Ohio, South-western: Thomson.
- Nourpanah, P., Ansary, N., Nourpanah, R., and Amini, S., (2011). Selection Six Sigma Project Use Gahp-Lp. Australian Journal of Basic and Applied Sciences, Vol. 5, No.12, PP: 1917-1922.
- Pettinger, R., and Frith, R., (2000). Mastering Organizational Behavior. 1st Ed., Macmillan Education, UK.