THE STRATEGIC USE OF SIX SIGMA TO ASSESS CAPACITY PLANNING IN EGYPTIAN WATER COMPANIES AS A COMPETITIVE STRATEGY

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Abstract

Increased productivity and cost reduction alongside customer satisfaction have been identified by firms as sources of competitive advantage. Different methodologies such as the Lean principle, pull scheduling, and Six Sigma are used by firms to achieve higher productivity as a competitive advantage. However, firms cannot produce infinitely due to limitations such as resources that is why it is so important to spot the light on capacity planning. This paper seeks to explore the significance of the application of Six Sigma on Companies' capacity planning to raise production efficiency by reducing defects and maximizing profits. Different companies of water in Egypt are used as study sites. A mix of qualitative and quantitative methods is used for data collection and analysis. A total of 200 participants were sampled for data collection using interviews and questionnaires. It is found that there is a significant correlation between the Utilization of Six Sigma techniques and monitoring of capacity planning in studied companies through improving and controlling quality processes until reaching zero defects products. It is also found that applying Six Sigma techniques could not be achieved appropriately without having a powerful information system and well-trained employees applying Six Sigma techniques efficiently.

Keywords: Application of Six Sigma, Capacity Planning, Production Capacity, Minimizing Deviations in the Production Process, Quality Improvement, Market Competition

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1. INTRODUCTION

Organizations are currently facing a dynamic environment that is characterized by diversity in the needs and aspirations of customers, in addition to more diversity in products. Therefore, competition is intensifying between organizations operating in the global market to attract the largest possible number of new customers while preserving existing customers, by providing distinguished products in terms of quality. Cost and in a manner that is commensurate with the constantly changing and renewed aspirations of customers, for the organization to achieve this, it must pay attention to improving its operations in a manner appropriate to the needs and desires of customers, which leads to an improvement in the quality of its products (Prashar, 2014). This has prompted many organizations to apply effective control approaches to keep pace with changes in the labor market and achieve competition to satisfy customers beyond their expectations. In this regard, firms are constantly seeking methods of improving their competitiveness to command a sizable market share. Increased productivity and cost reduction alongside customer satisfaction have been identified by firms

as sources of competitive advantage. In this regard, different methodologies such as the Lean principle, pull scheduling, and Six Sigma have been adopted by firms to achieve higher productivity as a competitive advantage. However, firms cannot produce infinitely due to limitations such as resources. In this regard, capacity planning which is a process of determining whether a firm's production capacity is sufficient to meet the customers' demands is implemented by Bubshait and Al-Dosary (2014). Monitoring capacity planning is vital to the production process and Six Sigma methodology is a crucial technique to offer to monitor the process. Six Sigma is a quality improvement and monitoring technique that seeks to identify and remove causes of defects thereby reducing variability in manufacturing and other business processes (Al Kindi et al., 2014). There are two major methodologies in Six Sigma: DMAIC (define, measure, analyze, improve, control) and DMADV (define, measure, analyze, design, and verify) (Yusr et al., 2012). DMAIC methodology is mainly used for projects which are geared to improve the processes of existing businesses while DMADV focuses on process design and the creation of new products (Desai & Shrivastava, 2008).

This paper will explore the utilization of Six Sigma, the methodology in the business process of companies of water. Process owners should be appointed who have a defined responsibility and authority to implement, maintain, and improve the processes. Documentation of processes should include process objectives, process map/flowchart, procedures, work instructions, quality plans, measurements and audit results, and information on ongoing and finished improvements. Goals and measurements of an organization's processes are often gathered and presented in a balanced scorecard (Kaplan & Norton, 1992).

To state the problem properly, competition and industry trends can greatly affect energy decisions (Antony et al., 2012). If several companies in a particular industry decide to add good capacity at one time, this may create an imbalance between supply and demand. However, as the market competition increases, companies are seeking ways of increasing productivity while cutting down the cost. However, in this quest to increase productivity, many firms often neglect the principle of capacity planning by forgetting that there is a maximum a firm can produce given its resources and market served (Karout & Awasthi, 2017). In this regard, many firms have lost resources by producing beyond the market demands or producing what the market does not need. Proper capacity planning with efficient monitoring methodologies such as Six Sigma can be a source of competitive advantage to companies. Companies of water are constantly expanding their operations and exploring the utilization of capacity planning and use of the Six Sigma technique these companies can be insightful on the importance of the methodology to ensure proper, effective, and efficient capacity planning in the companies.

As the aim of the study, the Six Sigma approach works to enhance the competitive position, increase market share, and maximize profits, as quality represents a major role in the survival and continuity of organizations in achieving competitive excellence. Therefore, the use of the Six Sigma approach helps organizations achieve high levels of quality and reduce defects and errors to levels that are almost non-existent at the lowest costs (Desai et al., 2015). This study aims to explore the significance of Six Sigma techniques in informing effective and efficient productivity and minimizing deviations that affect the requirements of the customers through capacity planning. Identify the deviations that appear during the production process. The companies have been at the forefront in the adoption of Six Sigma methodology to inform their business process.

In pursuance with the aim of the study, the following question will be adopted by the study to facilitate the achievement of the study aim:

RQ1: How is capacity planning conducted in the companies of water?

RQ2: How is the Six Sigma technique used to monitor capacity planning in the companies of water?

This research is important because of that, a research study is conducted to enhance knowledge in a given field and find solutions to identified problems. Six Sigma methodologies have gained increased focus and importance in modern business society due to their advantages of improving efficiency and cutting the cost of production of business, which increases the competitiveness of firms (Atanas et al., 2016). However, most water companies have not embraced the methodology to inform the manufacturing and service delivery process. The findings of this study will, therefore, reveal the benefits of the utilization of Six Sigma methodology for improving business processes, upon which other firms in the economy can emulate to improve their competitiveness. Moreover, the findings from this study will enrich the available literature on the utilization of Six Sigma to improve the efficiency and performance of a firm.

The structure of this paper is as follows. Section 1 represents an introduction that explains the problem, the study questions, the aims of the study, and a summary of the findings. Then there is Section 2 which reviews the relevant literature related to Six Sigma and capacity planning to achieve a competitive advantage. After that, there is Section 3 which illustrates the research methodology used to conduct empirical research. Then, there is Section 4 which concentrates on the results of the study in depth. Next, there is Section 5 in which there is a discussion of the study that leads finally to Section 6 which represents the conclusion of the study.

2. LITERATURE REVIEW

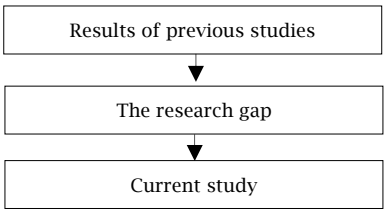
Six Sigma is a way to improve productivity and profitability, reduce defects and errors to the lowest possible extent, and identify improvement steps (Madhani, 2018). Six Sigma is a technique that measures the degree of variability of the business processes from the set goal (Ansari et al., 2011). The Six Sigma philosophy seeks to improve the performance of a business by reducing the number of defects to low levels of 3.4 occurrences per million opportunities (Desai & Shrivastava, 2008). Six Sigma is a business tool and strategy that seeks to improve customer requirements and even exceed customer expectations and understand the business system, productivity, and outputs, and its implementation has become familiar to researchers, managers, and workers at the practical and theoretical levels. Many practitioners and researchers from diverse fields have taken into

account the principles and practices of Six Sigma (Muhammad et al., 2022). The proper application of Six Sigma techniques cannot be achieved without a strong information system and well-trained personnel who apply Six Sigma techniques efficiently (Patel & Patel, 2020). Literature has indicated that the application of the Six Sigma methodology results in the improvement of the performance of a business by reducing causes of defects and variability in the production process. Applying Six Sigma rigorously and objectively will ensure the best results for companies and customers alike, which enhances quality levels and thus increases brand loyalty (Antony et al., 2012). Six Sigma is interested in addressing chronic problems of companies so that it can meet customer expectations cost-effectively and economically, and this is done from the beginning of the process through the industrial stages until the end of the process (Debnath et al., 2023). Research conducted by Chang et al. (2012) indicated that the application of Six Sigma enhances the performance of management and production planning. The study applied DMAIC to stimulate and improve performance. The main goal, according to the Six Sigma methodology, is to know the defects and identify them accurately, which enables them to be solved and avoided, thus good brand management and achieving maximum customer satisfaction (Madhani, 2020). Six Sigma methodologies have been heavily adopted by business entities across the world. Samsung Electronics, for instance, has heavily implemented the use of the methodology to improve its image as a competitive strategy (Gillet et al., 2010). The application of the Six Sigma methodology enables a business to detect problems in the production process and therefore allows the business to correct them to minimize losses (Valles et al., 2009). The Six Sigma curriculum aims to reduce delays through continuous improvement of the process and it is a highly accurate and organized process that develops high-quality services and products (Trubetskaya et al., 2023). In their study, Valles et al. (2009) applied Six Sigma to identify the problem in a semiconductor manufacturing company. Using DMAIC, the researchers were able to accurately identify the abrasive pressure and cycle time as the main causes of the defect in the design and experiment stages of production. Equally, research conducted by Tabsh (2015) to evaluate the performance of the hospital in Jordan using the Six Sigma methodology indicated that the method was efficient in detecting the causes of defects not only in production but also in service delivery. Increasing the number of profits is crucial, Six Sigma allows business owners to take a deeper look at their operations, and to make wise decisions based on facts, and usually leads to improving quality and maximizing profits. The higher the quality of products and services, the higher the size of the profits (Suryadi & Ngatilah, 2018). Using the methodology, the study was able to rank the performance of the hospitals sampled. With regard to managerial methods, the main purpose of the service-oriented production planning procedure is to consider the perspectives of clients or the operational strategies, and then focus on the horizontal procedure and quality to improve the company's competitiveness. Six Sigma is one method of quality improvement that boasts of the characteristics discussed above (Chen et al., 2009; Chau et al., 2009). It has been proven that creativity increases productivity in many ways as it can help to come up with new and better ideas, when you are more creative, you are better able to find new solutions to problems and come up with more innovative ideas (Fahmi et al., 2021). Waste is a common problem that affects productivity, efficiency, and profitability. After all, waste can come in many forms such as overproduction, excess inventory, waiting time, unnecessary movement, defects, and unused talent. Therefore, it is necessary to identify and eliminate waste (Tarigana et al., 2023). The Six Sigma methodology focuses on reducing and eliminating defects in business processes. The process methodology is divided into five sequential steps DMAIC. Each step is designed to help an organization make improvements in its business processes (Pisani et al., 2009). To utilize the information, the clear organization of information flows and basic Six Sigma tools should be useful to define the problem of enterprise information system integration. These improvements in business processes can be made in different types of industries such as manufacturing (Anand et al., 2007; Chen et al., 2009; Kaushik & Khanduj, 2009) and service (Kumar et al., 2009; (Wang & Chen, 2010) and include business processes that impact on information flows in an organization (Chau, 2009). Production capacity is defined as the number of units that can be produced during a certain period, as there are several types of energy such as maximum energy, normal energy, available energy, exploited energy, and optimal production energy (Mohammadi & Rezaei, 2020). In energy strategies, the current energy quantity is determined, future energy needs are predicted, and alternative methods of building energy are selected (Setiawan & Debora, 2020). The goal of production capacity planning is to determine the appropriate level of production capacity, which is determined by choosing the appropriate mix of machines, equipment, and workers required to meet future demand for the product, whether in the long or short term (Siddiqui, 2021).

Literature reviews have shown that there is a positive relationship between the application of Six Sigma and the improvement of performance levels reducing the rate of production defects, thereby reducing costs and increasing competitiveness.

Literature reviews have targeted companies that have already applied the Six Sigma approach, as they have tried to identify the obstacles that faced the application process and also study the relationship between the factors. Influencing the application process.

Figure 1. The research gap



Source: Author's elaboration.

General comment on previous studies: The results of previous studies show the importance of the applications of Six Sigma in improving product quality and improving the competitiveness of organizations.

The research gap can be identified by the fact that the current study deals with Six Sigma strategies, represented by linking Six Sigma to customers, as well as a competitive advantage, training, and teamwork and that all these dimensions were not combined in one study to determine their impact on product quality.

Research contributions come through overcoming the research gap that can be addressed by evaluating the impact of the application of Six Sigma on improving product quality.

3. RESEARCH METHODOLOGY

Research methodology refers to the strategy, the plan of action adopted, and the overall design which determines why a researcher considers a specific approach towards concluding the obtained results (Miles & Huberman, 1994). It, therefore, relates to describing, evaluating, and justifying the particular methodologies adopted. This study will adopt a questionnaire and methodology to guide the process of data collection. The questionnaire mainly involves the in-depth analysis of a single event, community, or group. This method of research enables a researcher to conduct a more detailed in-depth investigation of the participant. An observation and a questionnaire emphasize in-depth contextual analysis of a small number of conditions or events (Creswell & Creswell, 2017). Numerous advantages are associated with this research method, which has led to the wide application of the method of research in recent days across disciplines. The major strength of the research method regards its ability to use multiple techniques and sources of data (Kothari, 2004). An observation and a questionnaire to research have been vital in the gathering of data that has been used to build or dispute theories, offer an explanation to situations, and provide the basis for the application of solutions to identified problems. This method will facilitate in-depth analysis and evaluation of the effectiveness of the utilization of the Six Sigma methodology in the capacity planning by the firms identified as the case studies. Six Sigma is a problem-solving project, where each project contains a design or process problem and is looking for a solution. The successful strategy directs people's energies toward finding solutions and improving the basic production lines (Gibbons et al., 2012). Production capacity planning helps to increase production by making the best use of available resources without necessarily resorting to an increase in the number of employees or machines (Martyani et al., 2019).

Most of the literature reviews used a descriptive, field survey-based approach Descriptive analysis is based on personal interviews and the use of the questionnaire as a data collection tool.

Study participants will be drawn from 20 different companies of water in Egypt for data collection. Questionnaires and interviews were conducted with 60 heads, and technicians of various departments who are directly involved in the capacity planning of companies, and also there were interviews with 140 customers of the companies. Convenient sampling has been adopted to inform the choice of the study sample. Convenience sampling is a form of non-probability sampling, which pertains to the selection of a sample in a manner that increases the researcher's efficiency and convenience (Walliman, 2021). Application of Six Sigma methodology in business processes, accessibility, and willingness to participate in the study are the parameters considered in the identification of the study companies.

4. RESULTS

The study data was collected using the interview and the questionnaire tools and it was analyzed using appropriate tools and techniques. The quantitative data collected using the questionnaire tools were analyzed using statistical software for social sciences (SPSS) to explore the relationship between the improved efficiency in capacity planning and the adoption of Six Sigma methodology by companies of Water Egypt. In addition, sample summaries will be aided by the use of descriptive statistics. Descriptive statistics enables a researcher to summarize quantitative data in a manageable form. In this regard, graphs will be used to summarize the performance of the firms involved in the study as a reflection of the impact of the Six Sigma techniques in capacity planning.

For statistical analysis of application of Six Sigma to assess capacity planning, a field study applied to water companies in Egypt was conducted.

4.1. Constructing reliability test results

The researcher used the reliability analysis alpha scale to measure the stability of the content of the variables of the study, as shown in Table 1 the results of the statistical analysis show that reliability and validity coefficients are acceptable, as the lowest value of reliability coefficient was 0.86, and the lowest value of validity was 0.93.

Table 1. Values of reliability and validity coefficients for the survey list

Dimensions	*Reliability*	*Validity*
Application of Six Sigma	0.856	0.93
Optimal productivity	0.867	0.93

Source: Author's elaboration.

4.2. Descriptive methods

Table 2 shows that the employees were aware of the Six Sigma concept with its different dimensions. The lowest value for the arithmetic mean was 3.14, which is higher than the general arithmetic means of the scale, which reached 3, with a standard deviation of 0.375. The mean of the improve dimension was the highest 3.55 with a standard deviation of 1.22 which indicates the importance of taking care of the organization's strengths, weaknesses, opportunities, and threats until the success of the organizational change. Employees' awareness of the importance of capacity planning in order to keep up with all the tactical developments and improve the organization as this dimension obtained a mean of 3.48. The researcher sees that it is because of the positive effect of capacity planning on the employees through their work.

Table 2. The results of the descriptive data analysis for the study sample

Application of Six Sigma dimensions	*Mean*	*Standard deviation*
Information	3.30	1.14
Analyze	3.31	1.19
Control	3.49	1.02
Change	3.14	0.375
Improve	3.55	1.22
Performance	3.19	1.09
Incentives	3.38	0.655
Implementation	3.16	1.309
Optimal productivity	3.48	1.233

Source: Author's elaboration.

4.3. Testing the study hypotheses

4.3.1. Testing the first hypothesis

There is a significant correlation between the application of Six Sigma and optimal productivity by capacity planning which helps to eliminate resource loss. Table 3 shows the correlation coefficients matrix between the application of Six Sigma and optimal productivity.

Table 3 shows that there is a positive correlation between the application of Six Sigma dimensions *information*, *analyze*, *control*, *change*, *improve*, *performance*, *incentives*, and *implementation* and *optimal productivity*.

Table 3. The correlation coefficients matrix between the application of Six Sigma and optimal productivity

Dimensions	*Information*	*Analyze*	*Control*	*Change*	*Improve*	*Performance*	*Incentives*	*Implementation*	*Optimal productivity*
Information	1								
Analyze	0.89	1							
Control	0.74	0.88	1						
Change	0.45	0.58	0.53	1					
Improve	0.59	0.82	0.75	0.64	1				
Performance	0.66	0.75	0.56	0.48	0.78	1			
Incentives	0.87	0.76	0.63	0.44	0.65	0.46	1		
Implementation	0.69	0.77	0.67	0.76	0.48	0.89	0.89	1	
Optimal productivity	0.76	0.51	0.78	0.53	0.89	0.59	0.83	0.66	1

Note: The correlation is significant at a significant level of 5%.

The results of the statistical analysis are shown in Table 4 of the correlation coefficient of the application of Six Sigma dimensions under optimal productivity as a dependent variable.

Table 4. The correlation coefficient of the application of Six Sigma dimensions under the optimal productivity as a dependent variable

Application of Six Sigma dimensions	*Correlation coefficient optimal productivity*	*Significance level*	*Significance*
Information	0.76	0.0000	Significant
Analyze	0.51	0.0000	Significant
Control	0.78	0.0000	Significant
Change	0.53	0.0000	Significant
Improve	0.89	0.0000	Significant
Performance	0.59	0.0000	Significant
Incentives	0.83	0.0000	Significant
Implementation	0.66	0.0000	Significant
General correlation coefficient	0.75	0.0000	Significant

Note: The correlation is significant at the 0.05 level.

Table 4 shows that:

1) There is a significant correlation between all the dimensions of the application of Six Sigma and optimal productivity where the correlation coefficients ranged from 0.51 minimum to 0.89 maximum.

2) There is a positive significant correlation between the application of Six Sigma and optimal productivity, where the general correlation coefficient (R = 0.752) which means that (R = 75.2%) at the level of significance (α = 5%), which means that the management assured that the application of Six Sigma with its different dimensions, especially control which obtained a high correlation coefficient contributes to the success of optimal productivity.

3) The strongest correlation was between improvement and optimal productivity with a correlation coefficient of 0.89, which is significant at the level of significance (α = 5%), which means that the strategic analysis by identifying the internal factors of strengths and weaknesses, as well as identifying the external factors of opportunities and threats, contribute to the success of optimal productivity.

So, it is clear that there is a significant correlation between the application of Six Sigma and optimal productivity.

4.3.2. Testing the second hypothesis

There is a significant correlation between the utilization of Six Sigma techniques and monitoring of capacity planning in the organization ensuring removal of sources of defects in the production process.

Table 5. Statistics for testing the second hypothesis

Independent variable	*Dependent variable*	*Correlation coefficient*	*R^2*	*P-value*	*Significance level*	*T-value*	*Significance level*
Utilization of Six Sigma techniques	*Monitoring of capacity planning*	0.76	0.422	198.5	0.0000	18.2	0.0000

Note: The correlation is significant at the 0.05.

Table 5 shows that:

1) There is a positive significant correlation between the utilization of Six Sigma techniques and monitoring of capacity planning as the correlation coefficient was 0.67 which means that the independent variable (*Utilization of Six Sigma techniques*) has a positive effect on the dependent variable (*Monitoring of capacity planning*).

2) The value of the selection coefficient (R^2) is 0.422 which means that the utilization of Six Sigma techniques interprets about 42.2% of the monitoring of capacity planning.

From the statistics, we conclude that there is a significant correlation between the utilization of Six Sigma techniques and the monitoring of capacity planning in the organization ensuring the removal of sources of defects in the production process.

5. DISCUSSION

Ethical conduct in research requires researchers to protect the study participant from any form of harm and to ensure the accuracy of the study reporting (Loue, 2007). In this regard, the study seeks participants' consent to take part in the study before engaging them in the process of data collection. In addition, participant anonymity will be maintained throughout the study process. As the validity and reliability of the study are imperative to inform the accuracy and reliability of study findings, the study adopts an objective view as opposed to a subjective approach in the process of data collection (Loue, 2007). Finally, the research is committed to correct, accurate, and factual reporting of the study findings.

The companies under study need to adopt a good system to motivate employees, and this is done through the disbursement of incentives and bonuses to outstanding employees. Encouraging non-distinguished employees to improve their performance by identifying their training needs and providing appropriate training programs for them. Providing training programs that develop the skills of employees and increase their abilities to innovate and develop. Include the achievements of Six Sigma in the system of incentives and rewards. Continuous evaluation of the results of the application of the Six Sigma methodology and the implementation of the necessary adjustments and changes through the evaluation results. Developing and promoting the concept of self-control among employees to reduce the need for continuous supervision of them. The training should be continuous and appropriate to the continuous developments and changes.

6. CONCLUSION

The findings of the study showed an effective organizational infrastructure must be provided to successfully apply the Six Sigma methodology and support the continuous improvement process. Encouraging employees to recognize the importance of applying the Six Sigma methodology and the expected positive results through the effective application of the Six Sigma methodology. Identifying customer expectations and working to meet their needs according to the highest quality standards leads to achieving positive and effective results. The successful and effective application of the Six Sigma methodology strengthens the competitive position, increases market share, and maximizes profits. The successful application of the Six Sigma methodology helps to achieve high levels of quality and reduce defects and errors to the lowest levels and at the lowest possible costs, as it focuses on monitoring performance, activities, and processes, identifying the causes of differences or defects in the product, detecting and working to eliminate them before they occur to achieve the highest quality levels.

According to the qualitative method used in the research, the researcher conducted interviews with the managers of both quality assurance departments and production departments of the companies in Egypt. After analyzing the interview data, the researcher found that big companies applied Six Sigma techniques in the most efficient way which resulted in increasing the optimal production with high-quality products. In the second rank comes medium companies in applying Six Sigma techniques by maximizing optimal production but without using its full capacity production process this resulted in reducing waste in capacity planning without eliminating it. Small companies came in third rank in applying the Six Sigma techniques to achieve capacity planning due to a clear lack of training programs that deal with quality management, whether the programs for managers or technicians, so some of the companies suffer from a lack of training programs to help in applying Six Sigma techniques.

Although it was found that the information system applied in each company which ensures access to information to and from various departments in the companies differs from one company to another, also there is a great relationship between it and between applying Six Sigma techniques efficiently in a way which affect capacity planning too. For example, big companies have a powerful information system that helped a lot in applying Six Sigma techniques appropriately which helped in eliminating waste and achieving high-capacity planning. On the other side, medium companies have a very weak information system which leads to misleading information which leads to many problems.

All companies seek to achieve customer satisfaction and reduce internal costs at the same time. We can see this achieved in big companies that applied Six Sigma techniques efficiently, they succeeded in affording high-quality water products with low expenditure earning customer satisfaction. On the other side, many customers of the Egyptian companies had different complaints about the water products. So, the researcher sees that applying Six Sigma techniques helps in achieving customer satisfaction. This research is considered important for future research because it highlights the necessity and importance of the following: the possibility of applying the elements of Six Sigma is high, and the highest of these elements is the support of senior management, followed by the use of processes and information systems, followed by continuous improvement, then the use of feedback and measurement, as well as providing the necessary human resources. The effectiveness of management decisions is strongly based on data,

facts, and figures instead of guesses, and therefore reduces costs with concerted efforts among employees. Increasing understanding of customer needs and expectations, especially critical and urgent needs, and these are important characteristics in measuring the service provided to beneficiaries and seeking their satisfaction and affiliation with the institution. Reliability and effectiveness in internal operations, services, and activities, contribute to the service of all parties related to the organization. Knowledge is improved through the use by the organization of a set of tools and techniques that contribute to solving problems that lead to the creation of a kind of job satisfaction for employees. Reducing the number of unimportant operations by eliminating them in a systematic scientific manner, leads to the provision of services faster than before.

Paying attention to the Six Sigma techniques and emphasizing their application is important in reducing waste, improving product quality, and satisfying customers' desires. This application could not be efficient without having a strong, updated, and available information system, and it would not be effective without making a budget for training the employees on how to deal with Six Sigma and the fundamentals underlying it. Six Sigma approach is important in developing control systems in the companies. So, there is a necessity to provide all the needed elements to help in applying Six Sigma techniques efficiently like employees and technical needs.

The need to pay attention to the concept of Six Sigma and emphasize the possibility of its application, because it is important to improve the quality of operations by reaching zero errors, and improving the quality of products that match customer expectations.

In future, it is proposed to examine the relationship between the application of the Six Sigma approach and its role in increasing profitability and measure the level of Sigma in industrial enterprises.

This study is limited to the analysis of companies of water in Egypt regarding the study question. In this regard, the findings from this study are limited to Egypt. However, the findings will be vital to companies in other countries to inform them of the benefits of adopting the Six Sigma technique in their firms' capacity planning.

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