

A Systematic Literature Review on Using Six Sigma Methodology to Improve Customs Service Quality: Evidence from MENA Region

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To Link this Article: <http://dx.doi.org/10.6007/IJAREMS/v14-i1/24773> DOI:10.6007/IJAREMS/v14-i1/24773

Published Online: 18 March 2025

Abstract

This systematic literature review examines the application of Six Sigma methodology in various sectors across the Middle East and North Africa (MENA) region, with a particular focus on its potential for improving performance within customs services. The review synthesizes findings from numerous studies that have explored Six Sigma's effectiveness in diverse sectors such as healthcare, banking, education, and tourism. The results indicate that Six Sigma has significantly enhanced operational efficiency, service quality, and organizational performance, often through its data-driven approach to process improvement and waste reduction. Despite the extensive application of Six Sigma in these sectors, its implementation in the customs sector remains relatively underexplored. The review highlights the potential benefits of Six Sigma for customs operations, including reducing processing time, improving accuracy in customs declarations, and increasing overall service quality. However, successful implementation requires strong leadership support, employee training, and integration with technological advancements. The review concludes by identifying key challenges and proposing directions for future research, emphasizing the need for targeted studies on Six Sigma's role in transforming customs services in the MENA region to foster more efficient and competitive customs operations.

Keywords: Six Sigma, Service Quality, Customs Service Quality, MENA

Introduction

Customs services play a fundamental role in international trade by regulating the movement of goods across borders and ensuring compliance with local and global trade regulations

(Heijmann et al., 2020). These services include essential functions such as cargo inspection, customs declaration processing, and enforcing tariff and trade laws (Hoa, 2023). The efficiency of customs operations significantly impacts trade facilitation, as delays can disrupt global supply chains and economic stability (Saeed, 2024).

As international trade continues to expand, customs administrations face increasing challenges, including evolving regulatory frameworks, rising trade volumes, and the growing need to enhance efficiency while reducing operational costs (Karklina-Admine, 2024). The World Bank (2023) reports that customs clearance times in the MENA region exceed global benchmarks, negatively affecting trade competitiveness. Furthermore, the customs efficiency varies significantly across the Middle East and North Africa (MENA) region. The United Arab Emirates ranks 11th globally in the Logistics Performance Index, followed by Qatar and Bahrain, while Saudi Arabia, Egypt, and Jordan rank 38th, 58th, and 84th, respectively. These disparities highlight the pressing need for streamlined clearance procedures and improvements in regional trade competitiveness. Additionally, as compliance requirements with international and local customs regulations increase, there is a growing need to adopt effective strategies that enhance service quality and operational performance (Parthiban et al., 2020; Rbehat & Marafi, 2024).

Six Sigma is widely recognized as an effective methodology for improving quality and operational efficiency in several industries (Kumar et al., 2008; Bhat et al., 2023). Originally developed as a quality improvement framework in the manufacturing sector, Six Sigma aims to minimize defects to nearly zero (6 defects per million opportunities) through statistical analysis and process optimization techniques (Antony & Sony, 2020). Over time, its applications have expanded to include logistics and administrative functions (Sreedharan et al., 2020). Despite several previous studies, such as Abou Kamar (2014), Meteab et al. (2019), and Hafez (2015), which have shown that Six Sigma has successfully improved operational performance and reduced errors in various service sectors, its adoption in customs operations remains underexplored (Rodgers & Antony, 2019). Particularly in the MENA region. Furthermore, service organizations often encounter greater challenges in implementing Six Sigma compared to manufacturing industries due to the complexity of human, regulatory, and technological factors affecting performance (Antony & Sony, 2020). Therefore, integrating Six Sigma into customs administration has the potential to enhance procedural efficiency, expedite clearance processes, and reduce operational errors, ultimately improving satisfaction among importers, exporters, and logistics providers.

Thus, this study aims to address this gap by highlighting the effectiveness of Six Sigma in improving customs service quality and supporting institutional reforms aligned with international standards. Furthermore, it seeks to identify the critical success factors influencing Six Sigma's effective application in customs operations, providing a strategic framework to improve service quality and boost regional trade competitiveness.

The Research Significance

Enhancing customs efficiency is a strategic priority for governments in the MENA region, as the quality of customs services directly influences trade flows, logistics costs, and the attractiveness of regional markets for foreign investment (Jaud & Freund, 2015; Wanies-Guirgis, 2012). According to the World Bank (2023), several MENA countries continue to face

challenges related to infrastructure limitations, inefficiencies in audit and clearance procedures, and inadequate shipment tracking capabilities. Thus, this research highlights the critical role of Six Sigma in optimizing customs operations, enhancing efficiency, reducing clearance times, streamlining logistics processes, and enhancing customer satisfaction.

Research Questions

This systematic review aims to explore previous literature related to the application of the Six Sigma methodology in improving customs service quality in the MENA region. Given the limited studies that specifically addressed the customs sector, the research seeks to understand practical applications in other service sectors and assess research gaps. Accordingly, the following questions were formulated to guide the research and achieve its objectives:

1. What are the most prominent service sectors in which the Six Sigma methodology has been applied in the MENA region?
2. What are the main objectives and results of applying the Six Sigma methodology in previous studies in the MENA region?
3. What are the factors that affect the success of applying the Six Sigma methodology as stated in previous studies in the MENA region?
4. What are the research gaps in the literature related to the application of the Six Sigma methodology in the customs services sector in the MENA region?
5. How can the results of previous studies be invested to develop a framework for applying the Six Sigma methodology in the customs sector in the MENA region?

Methodology

Given the limited studies on applying Six Sigma to enhance customs service quality in the MENA region, this systematic review analyzes relevant literature from various service sectors. By addressing the study questions, it aims to provide a strategic framework for decision-makers to improve customs service efficiency and quality.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was adopted to guide the systematic review, and specific steps were followed to ensure the comprehensiveness and accuracy of the search. These steps included identifying appropriate databases and using relevant keywords, including Six Sigma in healthcare, Six Sigma in banking, Six Sigma in education, Six Sigma in the public sector, Six Sigma in customer service, Six Sigma in telecommunications, Six Sigma in tourism, Six Sigma in airports, Six Sigma in Service sector, Six Sigma in service organizations, and Six Sigma in hotels, with a focus on the MENA countries: Jordan, Saudi Arabia, UAE, Qatar, Kuwait, Bahrain, Oman, Iraq, Egypt, Libya, Sudan, Tunisia, Algeria, Morocco, Lebanon, Palestine, Syria, and Yemen. Reviewed scientific databases such as Scopus, Web of Science, ProQuest, and Google Scholar were also used.

To filter relevant studies, inclusion and exclusion criteria were determined. The inclusion criteria included studies that addressed the application of the Six Sigma methodology in improving service quality, especially those that focused on service contexts within the MENA region or that provided insights applicable to this context. Furthermore, the search was also limited to studies published between 2019 and 2024, and it was also limited to studies published in the English language. As for the exclusion criteria, they included studies not

related to the Six Sigma methodology or that focused on non-service sectors, in addition to non-reviewed articles or studies that lacked clear analytical data. After collecting the initial studies, these studies underwent a careful filtering process using the inclusion and exclusion criteria. Thus, the following table illustrates the stages of study selection from the initial extraction of studies to final inclusion based on pre-defined criteria.

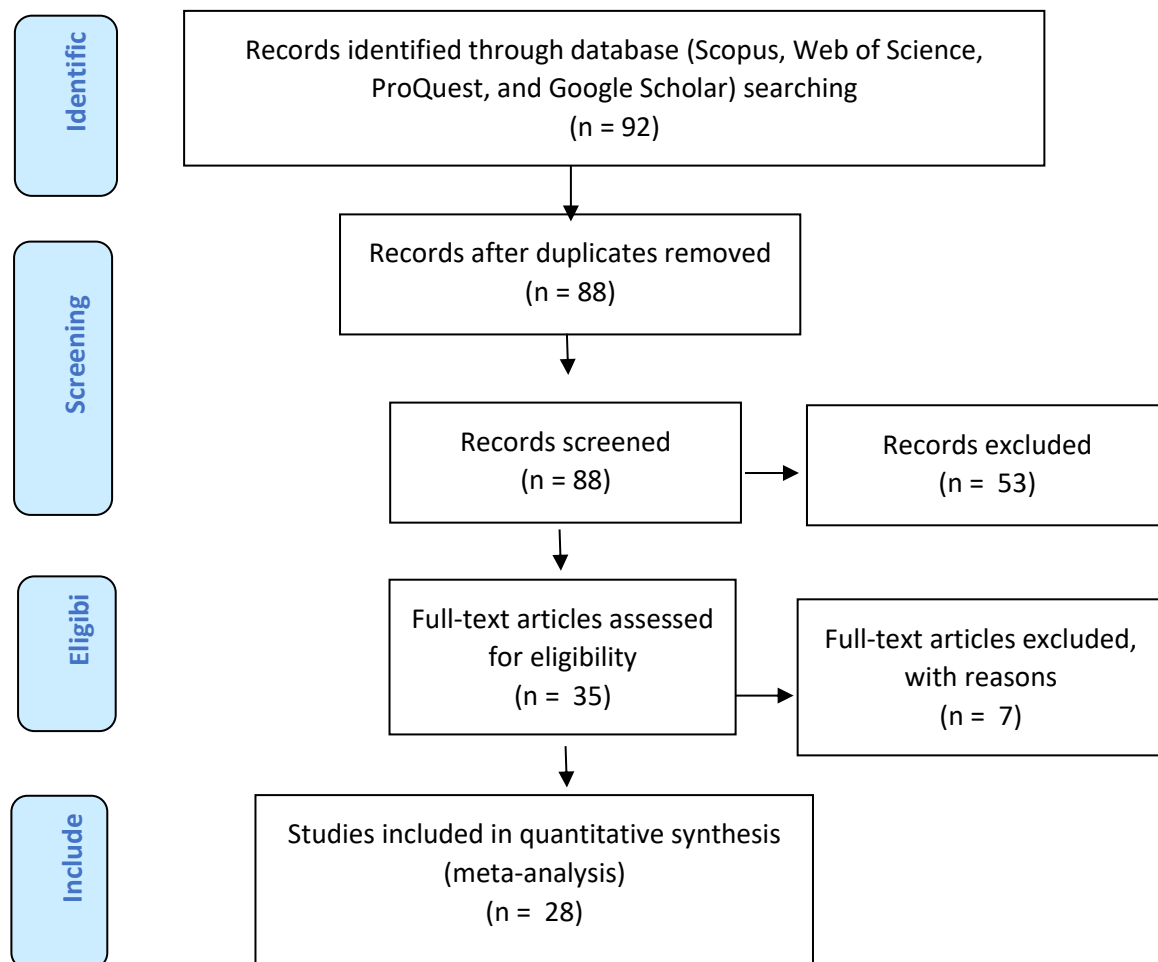


Figure 1: Data collection using PRISMA Protocol

The final set of 28 studies represents a comprehensive selection that is in line with the inclusion criteria and objectives of this review. These studies focus on the implementation of Six Sigma methodology in various service sectors in the MENA region. These studies will serve as the basis for a critical analysis of trends, success factors, challenges, and outcomes, providing valuable insights into the impact of Six Sigma practices in the region. The excluded studies did not meet the specified inclusion criteria.

Review of the Previous Literature

The Six Sigma methodology is one of the powerful tools used to improve quality and enhance operational efficiency in various sectors. Although many studies have addressed the application of Six Sigma in different sectors around the world, they have not addressed the application of the Six Sigma methodology in the customs services sector in the MENA region to the best of the researcher's knowledge. Therefore, this systematic review aims to shed light on previous studies that addressed the use of the Six Sigma methodology in improving service quality in this region, with a focus on other service sectors that may be relevant. By

analyzing these studies, the benefits and results that may be useful for applying Six Sigma in the customs sector can be extracted.

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Table 1

Summary of previous studies that addressed the application of the Six Sigma methodology in the service sectors in the MENA region

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
1	Hashim (2024)	Iraq	Higher Education	Investigate the requirements for applying the Six Sigma methodology and how it can be utilized to improve the quality of university education.	The application of the Six Sigma methodology can significantly improve the quality of university education.	Strong leadership commitment, proper training, effective communication, and the involvement of all stakeholders. The findings emphasize that by adopting Six Sigma practices, universities can achieve more efficient processes, higher student satisfaction, and continuous improvement in educational outcomes.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
2	Boudra & Benfettacha (2024)	Algeria	Telecommunication	Demonstrate the impact of adopting the Six Sigma method on the positioning of the company.	Six Sigma contributes to the company's positioning by identifying service quality issues and addressing them to meet customer needs with high quality.	Top management support, customer focus, service design, infrastructure, training and qualification, and continuous improvement
3	Alfatlawi & Alsaedi (2023)	Iraq	Banking	Demonstrate the effect of using Six Sigma standards to improve quality service banking	There is a direct, significant correlation between the Six Sigma standards with its researched dimensions and banking service quality.	Senior Leadership support, Feedback and measurement, continuous Improvement, Processes and systems, and Human Resources
4	Qeshta (2023)	Palestine	Public Sector	Determine the requirements for applying the Six Sigma methodology to develop the management performance of the employees of the Ministry of Youth and Sport.	The study found that support of senior leadership, feedback and measurement, continuous improvement, processes and systems, and human resources are critical criteria to adopt the Six Sigma methodology to improve management performance.	Support of senior leadership, feedback and measurement, continuous improvement, processes and systems, and human resources.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
5	Mistarihi et al. (2023)	Jordan	Healthcare	Investigate the effect of DMAIC and the simulation technique on reducing waiting time and enhancing system efficiency in the pediatric emergency department.	There are improvements in the performance of the process and productivity in the emergency department through adapting the combined Six Sigma and discrete event simulation methodology. The cycle time of the process was reduced by 73%, while simultaneously enhancing the total performance of the emergency department by 83%.	Allocating adequate resources, and training.
6	Shaheen et al. (2023)	Saudi Arabia	Education	Evaluate how the implementation of Six Sigma can improve the performance of the Madrasati platform in Saudi Arabia.	Applying Six Sigma enhanced process efficiency, reduced errors, and improved overall service quality. This resulted in increased user satisfaction and better outcomes in the educational processes on the platform.	-

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
7	Al-Khaldi et al. (2023)	Iraq	Banking	Exploring how the Six Sigma methodology can be applied to reduce costs and improve the quality of banking services.	Applying the Six Sigma methodology significantly contributed to reducing the costs of banking service quality, and it showed improvements in operational efficiency and service quality, leading to enhanced customer satisfaction.	-
8	Said et al. (2022)	Egypt	Airport	Present the role of the Six Sigma methodology in enhancing the performance of the provided services of Borg El Arab Airport.	The Six Sigma implementation realizes a high level of quality of provided services at Borg El Arab Airport.	Support and commitment of senior management, training, and focus on the customer.
9	Mahmoud Fathi (2022)	Egypt	Healthcare	Assess nursing staff readiness regarding utilization of Six Sigma in critical care units.	The result showed that the nursing staff had a fair knowledge level regarding the utilization of Six Sigma of quality management. Also, it showed that the majority of nursing staff had a low readiness level regarding the utilization of Six Sigma for quality management.	Support and commitment of senior management, training, and organizational culture.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
10	Yanamandra & Alzoubi (2022)	UAE	Service Organizations	Investigate the role of Six Sigma and Lean Operations in achieving the minimization of Cost of Quality in service sector companies.	Implementing Six Sigma in service organizations significantly reduces the Cost of Quality (COQ). Six Sigma's data-driven approach helps identify inefficiencies and reduce defects, leading to improved quality and lower operational costs.	Strong Leadership Support, clear communication, employee engagement, data-driven decision-making, and continuous improvement.
11	Al Nemari & Waterson (2022)	Saudi Arabia	Healthcare	The study aims to evaluate how the integration of robotics and Six Sigma methodology improves the efficiency, accuracy, and overall quality of the medication management process.	The integration of the Six Sigma methodology helped identify areas for improvement and optimize processes for enhanced patient safety and satisfaction.	Data-driven decision-making, and focus on patient safety and satisfaction.
12	Bahjat & Sadeq (2022)	Iraq	Healthcare	Explore the feasibility of applying the Six Sigma strategy in the healthcare sector to improve performance efficiency and enhance the quality of healthcare services.	The Six Sigma effectively improves healthcare performance and service quality by reducing errors and enhancing efficiency.	Focus on the beneficiaries, data-driven decision-making, focus on operations, effective management based on planning, management commitment, continuous improvement, the participation of individuals, and prevention rather than inspection.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
13	Ghaleb & Abdulahad (2022)	Iraq	Public Sector	Identify the extent to which the DMAIC Six Sigma methodology can be applied to control the quality of internal audit performance.	The DMAIC Six Sigma methodology, applied across its stages, improved internal audit performance by reducing errors, streamlining processes, and enabling data-driven solutions to workflow deficiencies.	-
14	Najm et al. (2022)	Jordan	Healthcare	Examine the impact of implementing Six Sigma practices on enhancing market performance in Jordanian hospitals.	The results confirm there is a positive impact of strategic vision, DMAIC cycle, and customer as dimensions of Six Sigma on the competitiveness and reputation of the company. The DMAIC cycle, however, does not seem to have a significant effect.	Strategic vision, DMAIC cycle, patient (customer) orientation and hospital commitment to employees.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
15	Alghasab (2022)	Kuwait	Public Sector	To identify the requirements for applying Six Sigma to improve administrative performance at Kuwait's Public Authority for Sports, focusing on management understanding, beneficiary satisfaction, staff training, and communication effectiveness.	There is a significant gap between the senior management and beneficiaries of the Public Authority for Sports in Kuwait, highlighting weaknesses in communication and transparency in governance. These issues hinder the effective implementation of Six Sigma.	Senior administration support, employee satisfaction, training and continuous improvement for employee, effective communication system.
16	Yassin et al. (2021)	Sudan	Healthcare	The study aimed to acknowledge the Six Sigma methodology, reduce operation time, minimize error rates, and improve service quality.	The application of the Six Sigma methodology achieved a satisfactory level of quality control and continuous improvement.	Support and Participation from Senior management, allocating adequate resources, and decision-making driven by data
17	Atia (2021)	Egypt	Auditing	Using the Six Sigma model to adjust the quality of the forensic auditing work.	There is a statistically significant relationship between the applications of standards Six Sigma raising the efficiency of forensic auditing work in audit facilities	Senior management support and commitment, reverse feeding, continuous improvement, operations and systems, and human resources.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
18	Al-Otaibi (2021)	Saudi Arabia	Universities	Examine the implementation of Six Sigma methodology in Saudi universities to enhance their competitive edge by improving operational efficiency, service quality, and overall performance in alignment with global education standards.	Implementing Six Sigma in Saudi universities improves their competitive edge by enhancing operational processes, reducing errors, optimizing resource use, and improving service quality, leading to better institutional performance and alignment with global education standards.	-
19	Bumjaid & Malik (2019)	Bahrain	Higher Education	The research aimed to evaluate the implementation of Six Sigma in Bahrain's HEIs and its impact on quality and employee performance.	The study found that Six Sigma is widely used in Bahrain's higher education institutions to improve quality, enhance efficiency, reduce costs, and minimize errors. It also positively impacts employee performance and work environments, with most institutions planning or implementing continuous improvement programs using Six Sigma.	DMAIC Approach, quality communication, continuous improvement, strategic decision-making, and data management.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
20	Basahel & Alqarni (2019)	Saudi Arabia	Airport	Evaluate the performance of King Abdulaziz International Airport using the Six Sigma methodology.	The implementation of Six Sigma at King Abdulaziz International Airport successfully improved performance by reducing process variation and increasing efficiency. The study demonstrated improvements in service quality, operational processes, and customer satisfaction.	Support and commitment of senior management, continuous improvement, and training.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
21	Dalalah (2019)	Kuwait	Telecommunication	Assess and benchmark Six Sigma strategies in services sector, particularly, the telecom field.	The key result of this research is that benchmarking Six Sigma implementation in the telecom sector identified critical areas of improvement in service quality and operational performance. The study revealed that Six Sigma practices significantly enhanced customer satisfaction, reduced service defects, and streamlined operational processes. The findings emphasized the importance of adopting Six Sigma methodologies to maintain competitive advantage and achieve consistent service excellence in the telecom industry.	Leadership commitment, employee involvement, effective training, communication, data-driven decision-making, and customer focus

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
22	Meteab et al. (2019)	Iraq	Tourism	Examine the impact of the Six Sigma techniques on enhancing strategic competitiveness through strategic re-engineering in the tourism industry.	Applying Six Sigma leads to improved operational efficiency, better service quality, reduced costs, and enhanced customer satisfaction, all of which contribute to a stronger competitive advantage for organizations within the tourism sector.	-
23	Alosani & Yusoff (2018)	UAE	Public Sector	Examine empirically the impact of Six Sigma on the organizational performance of Dubai Police.	The statistical results confirm that Six Sigma is an important continuous improvement tool that has a positive and significant impact on the organizational performance of Dubai Police.	Leadership commitment, strategic planning, and fostering an innovation culture.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
24	Qutait (2018)	Syria	Banking	Highlight the role of the Six Sigma approach to improve the banks' performance according to the implementation of the six elements of the Sigma model (DMAIC) and the selection of Six Sigma teams.	The study highlights the significance of adopting the Six Sigma methodology across industrial and service sectors. It reveals a growing trend among Syrian banks to leverage Six Sigma and demonstrates a statistically significant impact of Six Sigma elements (DMAIC) and team selection on performance improvement.	Customer focus, support, and support senior management, train employees and introduce each of them in turn to apply the methodology, continuous improvement, The existence of an effective measurement system, the existence of an effective information system, and customer focus.
25	Hussein et al. (2017)	Egypt	Healthcare	Use the Six Sigma methodology, based on the "Define, Measure, Analyze, Improve, and Control (DMAIC)" format, to analyze the emergency departments overcrowding problem and control the performance improvement plans.	The study demonstrates the effectiveness of using the integrated Six Sigma and discrete event simulation approach on reducing the ED crowdedness.	Support of senior management, organizational culture, and customer focus.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
26	Hafez (2015)	Egypt	Insurance	Utilize the integration between Six Sigma and balanced scorecard in internal auditing to be more effective and efficient in risk management.	The integration between Six Sigma and a balanced scorecard has a significant positive impact on internal audit effectiveness and efficiency.	Support and commitment of senior management, organizational culture, and continuous improvement.
27	Abou Kamar (2014)	Egypt	Hotels	Examine Six Sigma's impacts on various performance measures of upscale hotels.	The Six Sigma is relatively new in Egyptian hotels, with only 31% involvement and limited experience. However, its implementation significantly improves operational and competitive performance, surpassing other quality management programs like TQM and ISO 9001.	Top management commitment, organization infrastructure, incorporating Six Sigma into business's strategic plans, education and training, and measurement system.

No.	Authors	Country	Sector	Main Objective	Key Results	Success Factors
28	Sabry (2014)	Lebanon	Healthcare	Explore the critical success factors for a Six Sigma quality program's success and examine its impact on performance indicators.	the critical success factors (CSFs) that significantly influenced performance in Lebanese hospitals include: Executive Commitment, Adopting the Philosophy, Benchmarking, Training, and Closer Supplier Relationships. These CSFs demonstrated a positive and significant correlation with various performance indicators, such as cost reduction, efficiency in service, and customer satisfaction. However, the study also identified gaps in the adoption of some other CSFs and emphasized the need for improved focus in areas such as customer relationships and organizational structures to enhance hospital performance further.	Executive commitment, adopting the philosophy, benchmarking, training, closer customer relationships, closer suppliers' relationships, open organization, employee empowerment, engagement and morale, flexible operations, process improvement, measurement, organizational structures, zero defects mentality, teams, planning and values, audits, and problem-solving tools

The Most Prominent Service Sectors in which the Six Sigma Methodology has been Applied in the MENA Region

The Six Sigma methodology has been applied in a variety of service sectors in the MENA region, and previous studies have addressed Six Sigma methodology in many sectors. One of the most prominent of these sectors is the health sector, which has witnessed many studies that examined the Six Sigma methodology to improve service quality provided. such as, Mistarihi et al. (2023), Bahjat & Sadeq (2022), Al Nemari & Waterson (2022), Mahmoud Fathi (2022), Najm et al. (2022), Yassin et al. (2021), Hussein et al. (2017), and Sabry (2014). On the other hand, there have been many studies that examined the application of the Six Sigma methodology in the education sector. such as, Hashim (2024), Shaheen et al. (2023), Al-Otaibi (2021), and Bumjaïd & Malik (2019). In addition, Six Sigma has been used in the banking sector to improve service quality in this important sector. such as, Al-Khaldi et al. (2023), Alfatlawi & Alsaedi (2023), and Qutait (2018). Also, Six Sigma has been examined to improve service quality in telecommunications sector. such as, Boudra & Benfettacha (2024), and Dalalah (2019). Six Sigma has also been applied in the tourism sector, such as, Meteab et al. (2019). In the hotel sector, there was another study conducted by Abou Kamar (2014). Moreover, in the auditing sector six Sigma has been examined to improve performance quality as, Ghaleb & Abdulahad (2022), and Atia (2021). In the aviation sector, the use of Six Sigma was studied in a number of studies. such as, Said et al. (2022), and Basahel & Alqarni (2019). Finally, the application of Six Sigma was tested in the public sector, which is one of the important service sectors in MENA region, as Qeshta (2023), Alghasab (2022), Ghaleb & Abdulahad (2022) and Alosani & Yusoff (2018). Based on these studies, we can note that the most common service sectors in which the Six Sigma methodology was applied in the MENA region include the health sector, the education sector, the banking sector, the tourism sector, the hotel sector, and airports.

The Main Objectives and Results of Applying the Six Sigma Methodology in Previous Studies in the MENA Region

Several studies have shown a diversity of objectives and outcomes across sectors. The study by Yanamandra & Alzoubi (2022), addressed the impact of Six Sigma in the service sector in UAE to reduce quality costs. Furthermore, In healthcare, studies such as Yassin et al. (2021), Hussein et al. (2017), Mahmoud Fathi (2022), Mistarihi et al. (2023), Sabry (2014), Al Nemari & Waterson's study (2022), Najm et al. (2022), and Bahjat & Sadeq (2022) aimed to improve service quality and reduce errors and have succeeded in reducing process times and improving overall performance. In telecommunications, studies such as Boudra & Benfettacha (2024) and Dalalah (2019) have demonstrated the role of Six Sigma in addressing quality issues and enhancing customer satisfaction.

In the banking, studies such as Alfatlawi & Alsaedi (2023), Al-Khaldi et al. (2023), and Qutait (2018) have focused on improving service quality and reducing costs, with results showing a positive impact on customer satisfaction and operational efficiency. In the public sector, studies such as Qeshta (2023) and Alghasab (2022) have shown that the methodology can improve administrative performance despite communication and transparency challenges.

In the telecommunications sector, studies such as Boudra & Benfettacha (2024) and Dalalah (2019) examined the application of Six Sigma in the telecommunications sector. The studies

showed the Six Sigma methodology contributed to improving the quality of services, reducing defects, and increasing customer satisfaction.

In the higher education, studies such as Bumjaïd & Malik (2019), Al-Otaibi (2021), and Shaheen et al. (2023) provided insights into how to improve institutional performance through the Six Sigma methodology. have demonstrated the role of Six Sigma in improving the quality of education and increasing operational efficiency. In airports and hotels, studies such as Said et al. (2022) and Abou Kamar (2014) have shown significant improvements in service quality and operational competitiveness. Also, in the tourism sector, Meteab et al. (2019) highlighted Six Sigma's role on Iraq's tourism sector, improving efficiency, service quality, and cost reduction. On the other side, Hafez (2015) demonstrated that integrating Six Sigma with the balanced scorecard in Egypt's insurance sector enhanced internal audit effectiveness, showcasing its capacity to improve administrative performance.

The evidence shows that Six Sigma implementation has contributed to improving service quality, reducing errors, and increasing operational efficiency across the service sectors, while emphasizing the importance of overcoming implementation challenges to maximize benefits.

The Success Factors of Applying the Six Sigma Methodology as Stated in Previous Studies in the MENA Region

According to Table No. (1), previous studies in the MENA region indicate that the success of implementing the Six Sigma methodology depends on a set of common critical success factors, which vary in importance and impact according to the institutional context and sector. One of the key factors is the support of senior management, which is a critical factor for the success of any quality improvement project. Many studies such as Yassin et al. (2021), Boudra & Benfettacha (2024), Mahmoud Fathi (2022), Sabry (2014), and Hussein et al. (2017) have emphasized the importance of senior leadership commitment in promoting a culture of quality within the organization.

In addition, training and capacity building are another key factor, as studies such as Mistarihi et al. (2023), Hafez (2015), and Abou Kamar (2014) have shown that investing in training employees on Six Sigma tools and techniques enhances their ability to implement the methodology effectively.

Organizational culture is another factor that has been highlighted in several studies. Hussein et al. (2017), Sabry (2014), and Basahel & Alqarni (2019) have pointed out the importance of having a culture that supports change and continuous improvement.

On the other hand, customer focus has emerged as a critical factor in the success of the methodology's implementation, with studies such as Qutait (2018), Yanamandra & Alzoubi (2022), and Bahjat & Sadeq (2022) showing that understanding customer needs and expectations enhances the effectiveness of Six Sigma implementation.

Strategic planning and data management are also factors that have been clearly addressed. Studies such as Al Nemari & Waterson (2022), Dalalah (2019), and Hashim (2024) have emphasized that having thoughtful strategic planning and data-driven decision-making helps achieve improvement goals.

Effective employee communication and engagement have emerged as common factors in several studies, such as Said et al. (2022), Alghasab (2022), and Bumjaïd & Malik (2019). Continuous communication within the organization enhances the chances of success in implementing the Six Sigma methodology. Involving employees in the improvement process also increases their level of commitment and motivates them to innovate.

Finally, studies such as Ghaleb & Abdulahad (2022) and Najm et al. (2022) have indicated the importance of strategic vision and institutional commitment, as organizations adopting a clear and integrated vision contribute to enhancing collective efforts and achieving sustainable results.

A review of previous studies shows that the success of implementing the Six Sigma methodology in the MENA region depends on the integration of a set of factors, including senior management support, training, organizational culture, customer focus, strategic planning, effective communication, and collective employee participation. This integration between factors enhances the chances of improving institutional performance and achieving strategic goals in various sectors. Therefore, highlighting these factors for the success of implementing the Six Sigma methodology in the customs sector is of utmost importance, given the role of this vital sector in facilitating international trade and achieving efficiency in operations. The employment of these factors could contribute to significant improvements in the quality of customs services, calling for further studies directed towards this sector in the region.

The Research Gaps in the Literature Related to the Application of the Six Sigma Methodology in the Customs Services Sector in the MENA Region

According to Table No. (1), previous studies indicate that there are clear research gaps in the application of the Six Sigma methodology in the customs services sector in the MENA region, compared to other sectors such as healthcare, education, and aviation. Despite the focus on improving the quality of operations and services in these sectors, the literature lacks specialized studies that focus on understanding the application of the methodology in improving customs efficiency.

The gaps are evident in the absence of discussion on how the methodology adapts to the administrative and legislative complexities that characterize the customs sector, as well as the challenges associated with multilateralism, operational sensitivity, and the need to comply with laws. In addition, studies did not address the impact of applying Six Sigma on reducing customs clearance time and improving operational efficiency, nor the impact of cultural and organizational factors on the success of implementing the Six Sigma methodology in the customs sector in the MENA region.

Therefore, there is an urgent need for studies that aim to fill these gaps by developing applied models for the Six Sigma methodology in the customs sector in the MENA region, with a focus on the influencing factors, analyzing expected returns, and developing sustainable strategies that suit the nature of the sector in the region.

Developing a Framework for Applying Six Sigma Methodology in the Customs Sector of the MENA Region Based on Previous Study Results

To develop a framework for implementing the Six Sigma methodology in the customs sector in the MENA region, the results of previous studies can be utilized through several basic steps that take into account the factors that have influenced the success of implementing this methodology in other sectors, in addition to the challenges specific to the customs sector in this region.

First: Identifying the main factors that influence the successful implementation of the Six Sigma methodology

The results reached in previous studies indicate that the main factors that influence the success of implementing Six Sigma include the support and commitment of senior management, the allocation of sufficient resources, organizational culture, effective training, customer focus, and a focus on continuous improvement. Therefore, a framework must be designed based on these factors to ensure the success of implementing the methodology in the customs sector in the MENA region.

Second: Integrating Six Sigma with customs procedures and systems

Studies such as Hussein et al. (2017) have shown that improving performance by integrating Six Sigma with event simulation systems helps reduce waiting time and improve efficiency in vital departments such as emergency departments. Also, we find in the study of Yanamandra & Alzoubi (2022) the importance of including modern technical systems within the framework of applying Six Sigma to improve operational processes. Therefore, the framework can be developed by integrating the Six Sigma methodology with the customs systems followed in the MENA region to reduce the time spent in customs procedures and improve operational efficiency.

Third: Interaction with the cultural and organizational environment

Studies such as Sabry (2014) have shown that organizational culture and work environment are factors that affect the application of Six Sigma. In the context of customs, where operations are complex and sensitive, it is important that the framework includes elements that take into account the cultural and organizational challenges specific to this environment. The framework should include strategies to encourage a culture of change within customs agencies and enhance cooperation between various stakeholders. This idea is supported by the study of Atia (2021), which emphasized the importance of cultural and environmental influences in the success of the application of Six Sigma in different sectors.

Fourth: Setting measurable goals and achieving sustainable improvement

Studies such as Abou Kamar (2014) indicate the importance of having an effective measurement system to determine performance progress. Alfatlawi & Alsaedi (2023) also indicate the need to build a measurement system that includes comprehensive coverage of all customs operations to ensure accurate evaluation and achieve sustainable results. Therefore, the framework should include setting clear performance measurement standards in the customs sector using Six Sigma tools such as key performance indicators (KPIs) that allow for the evaluation of continuous improvements.

Fifth: Allocating the necessary training and resources

Previous studies emphasize the importance of continuous training for employees to ensure that they are fully aware of the Six Sigma methodology. Mahmoud Fathi (2022) indicated that training is an important element in the success of implementing the methodology. In addition, Sabry (2014) indicates the importance of effective training on appropriate techniques to accelerate process improvement in government institutions. Therefore, the framework

should include strategies for training customs employees on the tools and techniques used in Six Sigma such as DMAIC and FMEA.

Sixth: Interaction with stakeholders

As shown in the study of Said et al. (2022), where they pointed out the importance of focusing on customers in the continuous improvement process. The study of Bumjaïd & Malik (2019) also emphasized the importance of involving all stakeholders to ensure the success of implementing Six Sigma strategies in any sector. Thus, in the customs sector, many stakeholders are involved in the procedures, such as importers, exporters, and various government agencies. Therefore, the framework must include mechanisms to ensure effective communication between all these stakeholders.

By integrating these factors and the results extracted from previous studies, a framework for implementing the Six Sigma methodology in the customs sector in the MENA region can be developed. This framework should include senior leadership support, appropriate resource allocation, continuous training, integration of Six Sigma with customs systems, setting performance measurement standards, and interaction with the cultural and organizational environment, taking into account effective interaction between all stakeholders to achieve sustainable improvement in customs services.

Conclusion

A review of previous studies shows that the Six Sigma methodology has proven effective in improving performance quality and increasing efficiency in a variety of service sectors in the MENA region, including healthcare (Yassin et al., 2021; Sabry, 2014), banking (Qeshta, 2023; Alfatlawi & Alsaedi, 2023), education (Bumjaïd & Malik, 2019; Shaheen et al., 2023), and others. However, the application of Six Sigma in the customs sector in this region remains limited despite its great potential to improve customs performance.

Through a review of the literature, we find that the customs sector is considered one of the vital sectors that can greatly benefit from the Six Sigma methodology. This methodology can contribute to improving customs operations by reducing variation in procedures, reducing transaction times, improving the accuracy of customs declarations, and reducing costs associated with customs operations (Basahel & Alqarni, 2019). Implementing the Six Sigma methodology in customs can contribute to improving quality control, enhancing performance, and providing a more efficient work environment.

One of the main challenges facing the implementation of Six Sigma in this sector is the need for senior leadership support for the process, and providing continuous training for employees to ensure that they fully understand the methodology and apply it successfully (Alghasab, 2022). There is also a need to update the systems and technology that support the collection and analysis of data and achieve sustainable improvements in customs operations (Yanamandra & Alzoubi, 2022).

Based on the findings, it is recommended that future research should focus on studying Six Sigma applications in particular in the customs sector in the MENA region. Focus should be placed on studying the factors that affect the success of implementing this methodology, such as cultural and administrative challenges, in addition to technological innovation techniques that may support improving customs performance (Hafez, 2015; Meteab et al., 2019). It

should also be explored how Six Sigma can be integrated with existing customs systems to enhance operational flexibility and achieve sustainable improvements.

Ultimately, implementing Six Sigma in the MENA customs sector represents a significant opportunity to improve service quality, reduce costs, and increase efficiency. This requires strong leadership commitment, employee readiness, and integration of modern technologies to achieve effective results that contribute to improving regional and international trade.

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