

Unveiling Readiness Determinants for Introducing Lean Six Sigma in Healthcare Institutions

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Abstract

Healthcare plays a vital role in our lives since it directly impacts our well-being. However, the recent outbreak of the novel coronavirus has exposed the shortcomings of healthcare organizations in terms of efficiency and productivity. This issue is particularly pronounced in developing nations, where the challenges are even more significant. To address these challenges, Lean Six Sigma (LSS) methodology has emerged as a valuable tool. When implemented within healthcare organizations, LSS aims to enhance process capability and efficiency by minimizing defects and eliminating wasteful practices. In order to gain a better understanding of the impact of LSS in the healthcare sector, this study systematically reviews existing research conducted in this field. The findings reveal that a majority of the studies have primarily focused on improving management processes rather than medical processes. Additionally, there is a noticeable scarcity of studies conducted in developing nations. However, recent trends indicate a shift in research scholars' focus towards these nations as well. Nevertheless, it is important to note that the studies conducted in developing nations are predominantly empirical in nature, with only a few being conceptual or exploratory. This highlights the necessity for providing healthcare professionals with guidance on establishing a continuous improvement environment that sustains the progress achieved through LSS implementation.

Keyword:

Lean six sigma, Readiness, Systematic literature review

Introduction

Healthcare is an area where mistakes cannot be taken lightly. Even minor errors can have far-reaching consequences, potentially leading to fatal outcomes. A report from the journal of healthcare finance reveals that medical errors in the United States cost a staggering \$19.5 billion in 2008. Back in 1998, the Institute of Medicine estimated that 98,000 deaths could have been avoided that year if not for medical errors. Shockingly, by 2008, this number had risen to 200,000 deaths annually, averaging at 548 deaths per day or nearly one death every two minutes in the US alone [1]. To combat these preventable fatalities, Lean Six Sigma offers a powerful approach. Healthcare professionals who possess the knowledge and skills to utilize Lean Six

Sigma tools and methodologies can play a crucial role in resolving issues systematically and enhancing the quality of care. Moreover, they can not only save lives but also improve patient care and reduce operational expenses. The healthcare sector presents numerous opportunities for improvement, and Lean Six Sigma combines the strengths of Lean and Six Sigma strategies. Lean is renowned for its waste management capabilities, while Six Sigma is known for driving process improvement [3]. As Six Sigma symbolizes standard deviation, integrating these philosophies can enhance efficiency and quality by eliminating waste and reducing variability [4].

The initial step in the process entails the utilization of lean methodology to eliminate any unnecessary waste. Subsequently, by employing six sigma tools, we have the ability to enhance the variation in the process. These two methods are closely intertwined in the present era. Additionally, the combination of lean and six sigma yields positive outcomes in the improvement of process flow. The principles of six sigma and lean exhibit numerous similarities, which is why they are commonly practiced together. Ultimately, both approaches deliver similar value to both customers and businesses. It is noteworthy that lean and six sigma originated primarily from the manufacturing sector, particularly in automotive production. However, their application has now expanded to encompass diverse industries such as the public sector, customer service, and healthcare. The roots of lean thinking can be traced back to Henry Ford, who established the first mass production system by integrating standardized parts and efficient workflow. Subsequently, Kiichiro Toyota introduced new concepts, including value stream and Kanban, which ultimately became known as the Toyota production system in the 1990s. Over time, lean practices gained widespread recognition as an effective solution. The introduction of lean in manufacturing can be attributed to James Womack, an individual affiliated with the lean institute. When adopting a lean approach, the main focus is on qualitative tools. This is one of the reasons why most lean six sigma initiatives commence with lean methodologies, as qualitative tools are more intuitive. Understanding the concepts of lean and six sigma is relatively easier compared to implementing them successfully.

In today's ever-increasing healthcare costs and declining reimbursement rates, hospitals face the challenge of maintaining operational efficiencies, ensuring quality patient safety, and promoting employee engagement, all while meeting their financial goals. One approach that can address

these concerns is the integration of Lean and Six Sigma methodologies. By leveraging the combined power of Lean and Six Sigma, hospitals can enhance service quality, reduce costs, and minimize wastage, ultimately leading to improved healthcare outcomes [10].

It is important to note that Lean Six Sigma is not merely a set of tools or a methodology; it is a mindset and a psychological approach to driving change. Given that the healthcare industry heavily relies on human resources and intricate processes, it provides an ideal environment for the implementation of Lean and Six Sigma principles. While Lean Six Sigma has gained traction in various service and manufacturing organizations worldwide, its adoption in the healthcare sector, particularly in developing nations such as India, Pakistan, and Sri Lanka, remains relatively limited.

To bridge this gap, this study presents a systematic literature review of Lean Six Sigma implementation in healthcare organizations within developing nations. The aim is to explore the potential opportunities for improvement in these settings. By conducting such research, healthcare professionals can identify areas that require attention and develop targeted strategies to enhance organizational performance effectively.

Literature review

Exploring the literature within a specific topic or field is an integral and crucial process. When an individual embarks on reviewing the existing literature, a gradual formation of a comprehensive picture takes place, encompassing all the significant contributions that have shaped the development of that particular field. Through this literature review, one acquires knowledge about various techniques, scientific methodologies, and emerging technologies [11]. Moreover, it serves as a guiding compass, directing towards areas that require further research and study to advance the sector.

To conduct the current study's research methodology, three distinct steps are involved. Beginning with the first step, a Systematic Literature Review (SLR) is carried out. This step encompasses three sub-steps: accessing articles from diverse sources, excluding articles based on SLR's exclusion criteria, and then categorizing the selected articles according to various parameters. Moving on to the second step, the selected articles are thoroughly analyzed, uncovering notable trends such as the departments within healthcare organizations that receive

significant research focus. Lastly, the study considers future implications that can serve as a valuable guide for healthcare professionals to anticipate upcoming developments in the field.

Systematic literature review

A Systematic Literature Review (SLR) is a distinct method from traditional literature reviews. It involves a comprehensive and methodical exploration of relevant literature. The concept of SLR was first introduced by Tranfield, Denyer, & Smart in their research paper published in 2003 [12]. The process of SLR consists of three phases. The initial phase involves planning the review, followed by conducting the review according to defined inclusion criteria in the second phase. Finally, in the third phase, the identified articles are thoroughly reviewed [13].

To search for articles, specific criteria are applied, with a primary focus on topics related to the implications of lean six sigma methodology, the LSS framework in healthcare, and the healthcare sector itself. Additionally, the language of the articles is taken into consideration for the inclusion or exclusion of articles. Despite the formal search and collection strategy, the thoroughness of the literature review, particularly regarding the healthcare sector, was ensured. Consequently, articles that did not address the issue of lean six sigma in the healthcare sector were excluded. Research articles can be distinguished based on three key characteristics: place, research category, and time. The place refers to the specific country where the research study is focused. This country can either be a developed nation or a developing nation. On the other hand, the research category pertains to the type of article or the methodology employed in the research. The research category can be further classified into four types: conceptual, descriptive, empirical, and exploratory.

A conceptual research involves the development of theories and ideas through observations. Scholars may introduce new concepts or enhance existing methodologies, but experimental work is generally not required in this type of research [14]. In contrast, a descriptive research study encompasses a comprehensive examination of all the major contributions, changes, or events related to the field being investigated [15]. In order to gather data, surveys are conducted, indicating that the entire study is solely guided by the collected data, with the research scholars having no control over it.

Empirical research, on the other hand, is more experimental in nature. It utilizes observational methods to collect data, which is then validated through experimentation. Meanwhile, an exploratory study aims to address a new topic or a problem for which a solution has not yet been obtained or is still in its preliminary stage of development. This type of study assists in devising methods that may lead to a solution or provide a better understanding of the field. Lastly, the time characteristic indicates the year in which the study was conducted or published.

Systematic literature review of LSS in healthcare

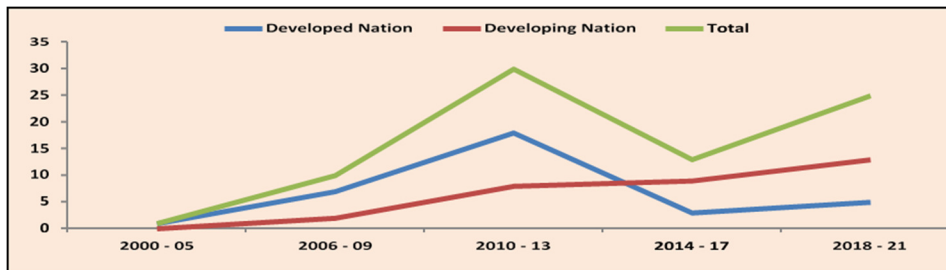
Healthcare is classified as a sector that provides medical assistance as a service. It is crucial to continuously enhance the efficiency and productivity of the healthcare system. This is because healthcare is not merely a business, but a system that profoundly impacts the lives of individuals. The introduction of the Six Sigma methodology in 1986 by Bill Smith and the Lean methodology in 1988 by John Krafcik took nearly ten years to be implemented in the healthcare sector. Initially, there were only a few research studies conducted on Lean and Six Sigma in healthcare. However, in 2001, there was a growing trend towards integrating Lean and Six Sigma. It was not until 2005 that the use of the Lean Six Sigma (LSS) methodology in healthcare became apparent. The integration of Lean with Six Sigma creates a powerful approach that reduces waste, improves productivity, minimizes errors, and enhances patient satisfaction. The present study considers a total of 80 articles, with a primary focus on developing nations and their healthcare organizations.

Several empirical studies have been conducted to examine specific hospitals or departments within hospitals. For instance, Usha Manjunath et al. (2007) implemented Lean Six Sigma (LSS) methodology in an Indian hospital, while Giovanni Improta et al. (2019) applied LSS to reduce the length of stay for patients in an Italian hospital. These studies are crucial in the development of the field as they provide a comprehensive understanding of advancements and identify areas that require further research. Similarly, the healthcare sector has also conducted literature reviews to enhance knowledge in the field.

Results and discussions

The implementation of Lean Six Sigma (LSS) in the healthcare sector did not commence before 2005. Extensive research on LSS in healthcare has already been conducted worldwide, but the amount of research carried out in developing nations like India and Brazil, in comparison, has been relatively limited. The categorization of articles based on time constraints is essential as it provides insight into the changing trends and the number of research studies conducted each year to address this issue. Additionally, it also reflects how the researchers' focus has evolved over time. Until 2013, research scholars primarily concentrated on enhancing healthcare. The emphasis in the field of developed nations has shifted to developing nations since 2014, as these nations require more effective systems. A significant 41 percent of studies have focused on organizations in developing nations, and an additional 30 percent of articles in the developing nations category have addressed healthcare organizations in India. It is crucial to acknowledge this trend because a study conducted in a specific location highlights the importance and necessity of addressing a unique problem and finding a solution tailored to that particular place. As different places have different problems, the approach must be defined according to the requirements of that specific location.

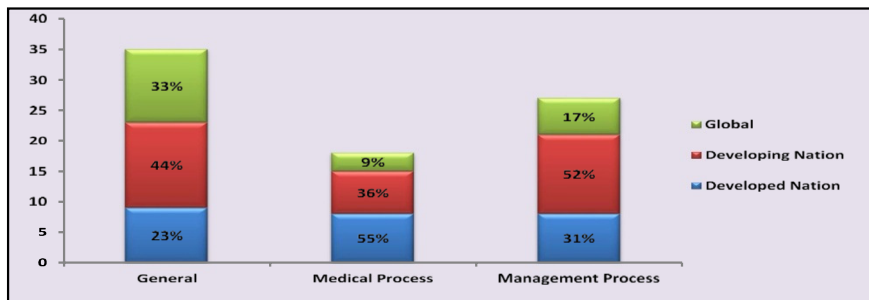
Year wise distribution of the research articles



Categorization of the articles according to place



Characteristics of articles according to process



Implications and future opportunities

Upon examination of the articles incorporated in the present study, certain domains or subjects were discovered to be deficient in terms of research. Furthermore, these areas can be perceived as prospective prospects for both research scholars and healthcare experts to delve into. Consequently, healthcare practitioners could potentially pinpoint areas that require further investigation, thereby fortifying their respective organizations.

The topics listed below will serve as guiding principles for future research endeavors:

1. **Medical Procedures:** Further investigation is necessary to explore the application of the Lean Six Sigma (LSS) approach in minimizing defects and waste associated with surgical procedures, including therapies and operating rooms. Existing studies primarily focus on managerial processes or the overall organizational structure.
2. **Cultivating a Culture of Continuous Improvement:** Following the implementation of the LSS approach, healthcare managers need to be motivated to foster a philosophy of continuous improvement. This is vital for sustaining the achieved gains and identifying potential opportunities. Interestingly, the authors found no studies addressing this particular topic.
3. **Sustainability:** It is crucial to consider environmental factors in the healthcare industry, given the generation of biohazardous waste that can harm the ecosystem. To promote sustainable improvement, LSS can be integrated with green technologies, establishing an environmentally conscious framework.
4. **Supply Chain:** The COVID-19 pandemic has exposed the inefficiencies and lack of preparedness in the healthcare sector's supply chain. However, challenging times often provide

valuable lessons. Hence, it is an opportune moment to reflect on these issues and develop an LSS framework that can effectively navigate similar uncertain situations.

Additional research is needed in developing countries. Furthermore, the majority of studies have been focused on India, with limited attention given to other developing nations such as Sri Lanka, Pakistan, Bhutan, and Bangladesh.

Moreover, the research conducted in these developing nations has primarily been empirical in nature. It is crucial to include more conceptual and exploratory studies as they have the capacity to address the distinct challenges faced by each individual country. This is essential because each country has its own unique policies and regulations that may pose obstacles for implementing successful Lean Six Sigma (LSS) models that have worked in other nations.

Improving the performance of healthcare organizations is a pressing necessity in light of the challenges faced during the COVID-19 pandemic. To prevent the recurrence of such difficulties in the future, healthcare managers must prioritize the implementation of process improvement methodologies such as Lean Six Sigma. The adoption of Lean Six Sigma is driven by the desire to reduce defects and inefficiencies in medical procedures, particularly in surgical settings and operation theaters. Once the LSS methodology is initiated, healthcare managers should strive to establish a culture of continuous improvement within their organizations. This ensures the sustainability of the implemented improvements and enables the identification of new opportunities for enhancement. Additionally, it is crucial for healthcare professionals and managers to consider the environmental impact of their operations. The healthcare sector generates bio hazardous waste that can have detrimental effects on the environment. By integrating Lean Six Sigma with green methodologies, organizations can effectively address this issue. This integrated approach, known as green lean Six Sigma, serves as a powerful catalyst for enhancing the quality, effectiveness, and efficiency of healthcare organizations. Consequently, healthcare management teams are motivated to implement this method to promote sustainable development within their organizations. Nevertheless, it is evident that the implementation of LSS in the healthcare sector, especially in developing nations, still has a long way to go.

Conclusion

The healthcare industry plays a crucial and intricate role in society, encompassing various departments. Any failure or shortcomings within one department can adversely affect the quality of patient care. This was especially evident during the Covid-19 pandemic, highlighting the urgent need for operational excellence in healthcare operations. To address these challenges, Lean Six Sigma emerges as a highly effective methodology. By utilizing the tools and principles of lean manufacturing and Six Sigma, it can significantly reduce waste and variation within an organization. Although originally established for the manufacturing sector, Lean Six Sigma has gained prominence over the past decade in non-manufacturing industries, including the service sector. Recognizing the disparity in research conducted in developing nations, there has been a notable increase in studies focusing on these regions. However, existing research in the healthcare sector primarily concentrates on the management of operations. There is a pressing need for further investigation into minimizing waste and defects specifically in surgical and operation theatre activities. Furthermore, it is essential to provide guidance to healthcare professionals on cultivating a culture of continuous improvement. This includes sustaining an environment conducive to progress and enhancing processes to ensure long-term effectiveness. Dedicated researchers tirelessly strive to perfect and optimize healthcare organizations, ultimately enhancing the lives of individuals. Undoubtedly, the healthcare sector is vital to our survival and well-being.

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