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Why do Process Improvement Projects Fail in Organizations? A Review and Future Research Agenda

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Purpose: The purpose of this article is to examine the Critical Failure Factors (CFFs) linked to various types of Process improvement (PI) projects such as Kaizen, Lean, Six Sigma, Lean Six Sigma and Agile. Proposing a mitigation framework accordingly is also an aim of this study.

Design/ Methodology/ Approach: This research undertakes a systematic literature review of 49 articles that were relevant to the scope of our study and that were published in four prominent databases including Google Scholar, Scopus, Web of Science and EBSCO.

Findings: Further analysis identifies 39 factors that contribute to the failure of PI projects. Among these factors, significant emphasis is placed on issues such as "*resistance to cultural change*," "*insufficient support from top management*," "*inadequate training and education,*" "*poor communication,*" and "*lack of resources*", as primary causes of PI project failures. To address and overcome the PI project failures, we propose a framework for failure mitigation based on change management models. We present future research directions that aim to enhance both the theoretical understanding and practical aspects of PI project failures.

Practical Implications: Through this study researchers and project managers can benefit from well-structured guidelines and invaluable insights that will help them identify and address potential failures, leading to successful implementation and sustainable improvements within organizations.

Originality: This paper is the first study of its kind that examine the CFFs of five PI methodologies and introduces a novel approach derived from change management theory as a solution to minimize the risk associated with PI failure.

Keywords: *Process improvement, Critical failure factors, failure mitigation, change management, Kaizen, Lean, Six Sigma, Lean Six Sigma, Agile, sustainable performance.*

International Journal of Lean Six Sigma

1. Introduction

Process improvement is a central activity of process enhancement, measured through the perceived quality of real outcomes, the time duration to complete the process, the financial cost of running the process and the process flexibility to adapt to external or internal changes (Chión *et al.*, 2020). PI relies on established methods, techniques and tools to re-engineer and redesign processes (Malinova *et al.*, 2022). It is of utmost importance to achieve business goals in terms of efficiency and performance (Dave, 2017). [4][5], [6][7]

In the quest for organizational excellence, PI projects emerge as preferred choices promising increased efficiency, streamlined operations, enhanced performance and better customer satisfaction (Mitra Debnath, 2019; Ramadan *et al.*, 2022; Singh and Singh, 2018; Su *et al.*, 2014; Zhu *et al.*, 2018). Likewise, there is plenty of evidence that PI implementation is associated with the professional development of human resources, teamwork and motivation (Liu *et al.*, 2015; Vento *et al.*, 2016; Zavyalova *et al.*, 2020). PI projects often attract considerable resources and utilize cross-disciplinary teams with soaring expectations. Nevertheless, not all PI projects attain their desired outcome. According to [9], it is asserted that two-thirds of process improvement (PI) initiatives were unsuccessful, and as much as 70% of Lean Six Sigma (LSS) projects are prematurely terminated. Furthermore, 60 % of Six Sigma (SS) projects fail to achieve the expected results (McLean *et al.*, 2017; Sony *et al.*, 2019) while less than 10% of UK organizations have successfully implemented lean projects (McLean *et al.*, 2017). Moreover, 50% or more of kaizen projects were unable to sustain the initial improvement over time(Glover *et al.*, 2011). The high failure rate of PI projects is a major concern for organizations, resulting in several millions of dollars in costs and adverse effects on their overall business performance (Antony *et al.*, 2019, 2022; McLean *et al.*, 2017; Swarnakar *et al.*, 2020).

Measuring the success or failure of PI implementations can be contentious, as various individuals may have differing perspectives on how to assess failure (Aloini *et al.*, 2007). Traditionally, project failures have been measured using the “iron triangle”, which encompasses quality, cost and time (Gupta *et al.*, 2019).

International Journal of Lean Six Sigma

Despite meeting the technical requirements, a project may still be deemed to fail if it surpasses the allotted budget or timeline. Conversely, a project could be considered successful even if it falls short of budget or timeline(Thomas and Fernández, 2008). In this case, managers pay penalties due to delays resulting in increasing the overall project cost (Belassi and Tukel, 1996). Furthermore, while the project was a success from the management's standpoint, it could be perceived as a clear failure from the customer's view (Savolainen *et al.*, 2012). Thus, the criteria for determining project failure have evolved based on the project life cycle, accounting for several factors such as project complexity, industry types, size and customers to support organizational competitiveness in an ever-changing business environment (Ojiako *et al.*, 2008). Although generic projects and PI projects have shared characteristics such as clear goals, a structured project approach and trained experts to execute the project, they have fundamental differences in terms of benefits obtained by PI implementation and their impact on organizational performance. Furthermore, the mandatory role of leadership and top management in PI deployment and the statistical tools and methodologies used for the project's excursion further set them apart (Lameijer *et al.*, 2022). Accordingly, PI project failures are determined when the project fails to achieve the anticipated financial, organizational, operational, or social objectives(Shokri *et al.*, 2022). As the failure of PI implementation is closely tied to the benefits, acquiring a comprehensive understanding of the CFFs and their influence on the various organizational performance facets endure significant importance in the pursuit of PI success (Lameijer *et al.*, 2022).

In the era of globalization and rapid technology development, various PI approaches have become core elements of organizational strategy to improve their performance and remain competitive in the market continuously (Adebanjo *et al.*, 2016). Indeed, a variety of PI methodologies, including Kaizen, Lean, SS, LSS and Agile, have been implemented to improve quality, performance and customer satisfaction (Antony *et al.*, 2022; McLean *et al.*, 2017). Despite variations in the adoption approach, all PI methodologies share philosophical essence and concur on a common goal of better improvement (Näslund, 2008). Kaizen is a management approach that emphasizes ongoing enhancement through gradual, incremental modifications that can yield substantial outcomes when executed collectively (Glover *et al.*, 2011). Unlike other PI

International Journal of Lean Six Sigma

methodologies, it is designed to attain significant improvement in a period of one week or less(Franken *et al.*, 2021). Lean, on the other hand, is an approach focused on improving performance and eliminating waste to deliver customer value sustainably (Régis *et al.*, 2019). SS is a well-structured problem-solving methodology that aims to reduce process variation and achieve a quality level of 99.99966%, which corresponds to only 3.4 defects per million units (Kuvvetli *et al.*, 2016). While lean lacks the statistical tools needed to resolve complex problems that require data analysis and advanced statistical methods (Antony *et al.*, 2017), SS does not link quality and speed (Delgado *et al.*, 2010). Thus, combining the tools of both methodologies has been shown to result in faster and more effective performance improvement than applying them independently (Thomas *et al.*, 2016).

The merger of Lean and SS, known as Lean Six Sigma (LSS), is a well-established PI methodology that focuses on improving efficiency and quality by reducing variation and waste (Laureani and Antony, 2018). A distinctive characteristic of LSS is its appropriateness in solving complex cross-functional problems and improving performance (Shokri *et al.*, 2016). To achieve the desired level of improvement, a sufficiently trained team and technical specialists often referred to as Green Belts, Black Belts, Master Black Belts and Champions implement SS/LSS projects to ensure the efficient use of tools and techniques (Antony *et al.*, 2021; Kumar *et al.*, 2008). Agile examines an organization's exceptional capacity to embrace change in customer demand and respond quickly to sustain a competitive edge in a dynamic environment (Nabass and Abdallah, 2019). Thus, Agile concepts have been focused on flexibility, responsiveness, and mastering demand turbulence (Oloruntoba and Kovács, 2015). It is particularly suitable for high-variety, low-volume companies producing innovative products with short product life cycles and volatile demand (Bruce *et al.*, 2004; Mostafa *et al.*, 2016).

Although numerous researchers have highlighted different drivers for successful PI implementation and critical success factors (Knol *et al.*, 2018; Lameijer *et al.*, 2021; Marzagão and Carvalho, 2016; Radhakrishnan *et al.*, 2022), there is still a limited comprehension of PI failures and their impact on

International Journal of Lean Six Sigma

organizational performance (Antony *et al.*, 2022). The existing literature on PI failures overlooks the exploration of Kaizen and Agile. The emphasis of other reviews was predominantly on the failure of LSS (Albliwi *et al.*, 2014) while it is important to acknowledge that certain identified failure factors were referred to as barriers to the successful implementation (Patel and Patel, 2020). Additionally, other reviews were dedicated to the manufacturing sectors neglecting the service industry (McLean and Antony, 2014; McLean *et al.*, 2017). Furthermore, existing studies have failed to address the divergences of the failure factors among different PI methodologies, it is unknown if the failure of PI deployments is attributed to the impact of the same underlying factors. More importantly, there is a notable absence of established frameworks, strategies or practices to effectively mitigate or help organizations to avoid failures.

There is an important need to address these shortcomings in the literature and develop a suitable framework capable of identifying the CFFs of PI projects. In light of this gap, the present study systematically reviews 49 relevant academic articles to identify reasons for the PI project's failure and proposes a mitigation framework accordingly. This work updates the previous reviews (Albliwi *et al.*, 2014; McLean *et al.*, 2017; Soliman, 2017) by focusing on case studies and empirical research in the context of five distinct PI methodologies across sectors. Additionally, we delve into the examination of failure factors to identify shared characteristics among various PI methodologies, as well as to reveal any distinctive factors that might be present. This work further distinguishes itself from the previous reviews by proposing a mitigation framework that contributes to sustainable outcomes of PI projects. Accordingly, the following are the research objectives of this study:

RO1. Identify and classify the Critical Failure Factors (CFFs) to gain valuable insights on factors that contribute to the failures of PI projects.

RO2. Propose a mitigation framework for PI project failures.

RO3. Outline key future research directions pertaining to PI project failures.

International Journal of Lean Six Sigma

The remainder of this paper is organized as follows: Section 2 outlines the methodology and selection criteria and Section 3 identifies and categorizes the CFFs of PI methodologies. We proceed with the proposed mitigation framework in Section 4 and Section 5 presents the discussion and conclusions of the study result. Finally, Section 6 summarizes the key future research directions.

2. Methodology

To meet the research objectives, this study uses a systematic literature review (SLR) approach to identify the critical factors contributing to PI project failures. SLR is chosen because it improves the review validity by providing well-defined steps to be followed and enhances the generalizability of the findings by identifying relevant patterns, themes and issues within the field (Musawir *et al.*, 2020; Wang and Chugh, 2014). It is considered superior to other types of reviews as researchers can replicate the research steps to verify the results (Aarseth *et al.*, 2017). Given the demonstrated success of SLR in the context of project management and process improvement (Albliwi *et al.*, 2014; Lameijer *et al.*, 2022; Xia *et al.*, 2018), we adopt the SLR methodology described in (Tranfield *et al.*, 2003) to ensure that no significant failure factor is overlooked. This approach compromises three stages: planning, conducting and reporting the review described below.

2.1. Stage Ⅰ - Planning the review.

The planning stage is the initial stage of the systematic review to clarify and determine the research objectives and boundaries (Figure 1). A review protocol was developed that explicitly describes the steps to be followed during the SLR process. To ensure the quality and relevancy of papers included in line with the research objectives, we set the inclusion criteria listed in Figure 1.

International Journal of Lean Six Sigma

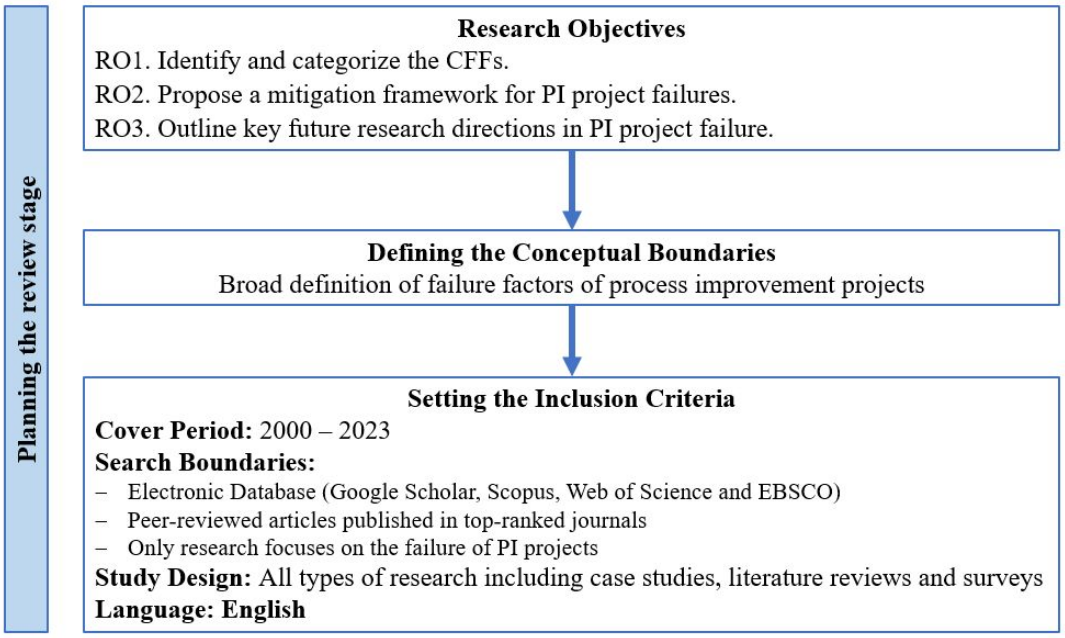

Figure 1. Flow diagram for the planning stage

2.2. Stage Ⅱ – Conducting the review

Figure 2 shows the conducting stage followed in this SLR. Different combinations of keywords to search the articles from the databases as presented in Figure 2. Flow diagram for conducting the review stage. The initial search resulted in a large number of articles. Taking into consideration the predefined inclusion and exclusion criteria, only 811 studies were considered for the next stage. Screening abstracts has resulted in most of the relevant papers not primarily written about PI failure. We adopted the content analysis technique to diagnose potentially relevant papers and several PI implementation studies were reviewed, looking for explicit references for failure such as "*the project fail*", and "*the project freeze at a specific stage*". By merging the results from all resources, full-text assessment and reading, deleting duplicates and tracking the references of each paper, a final sample of 49 articles was considered for the analysis. Codes were developed using labels with descriptive information on the year of publication, author(s), journal, PI used, country, sector, organization size, and the critical factors of failure. Two other authors independently validated each round of screening, and all articles were re-checked until an agreement was reached to triangulate data and ensure a high degree of inter-rater reliability of the resulting database (Wang and Chugh, 2014).

International Journal of Lean Six Sigma

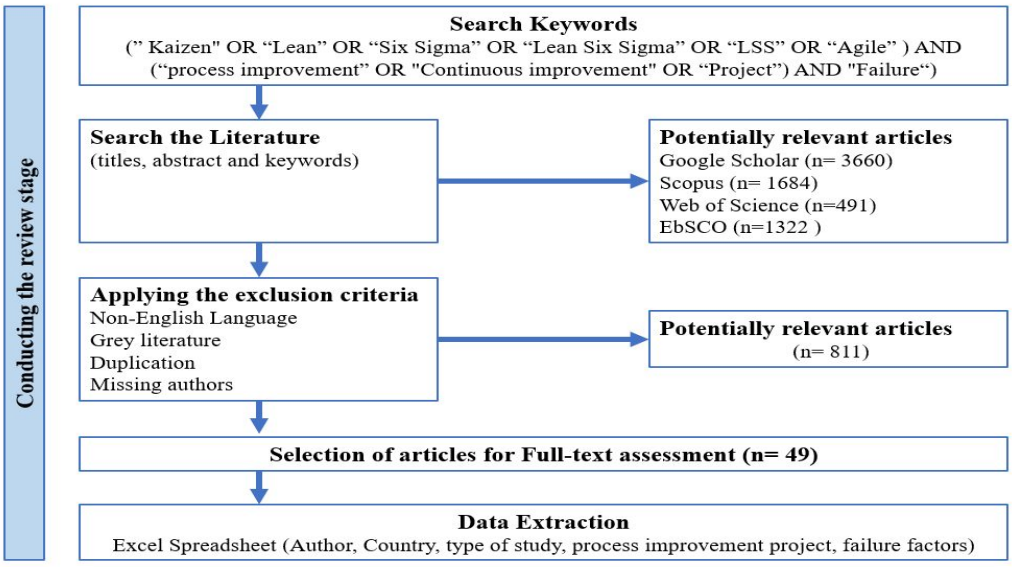

Figure 2. Flow diagram for conducting the review stage

2.3. Stage Ⅲ – Reporting

In line with Transfield's et al. (2003) recommendations (Tranfield *et al.*, 2003), the findings of the SLR are presented in the result and discussion section. The article sample includes 49 articles published from the years 2007 to 2023. The initial article that fulfills the study criteria was published in 2007(Chow and Cao, 2008) and highlighted the success and some failure factors of Agile projects. It is worth noting that the research topic on project failures has been predominantly published in management and quality-oriented journals. The reviewed articles were sourced from 26 different journals indicating a wide range of journals covering PI failures. The selected articles covered various PI methodologies implemented in different industries with a significant focus on LSS. Among the 49 articles, 12 papers focused on PI or CI project failures without specifying any particular methodology. Additionally, there were six articles specifically dedicated to discussing Kaizen implementation, nine articles on lean, six on SS, 12 on LSS and 4 discussing agile methodology. In terms of the research methodology employed in studying PI failures, we observed that case-based, survey-based or reviews were the most commonly utilized methods. The CFFs were extracted from these 49 articles, and those with similar content and descriptions were grouped together. In total, 39 CFFs were identified and classified into five categories (Managerial and leadership, Organizational,

International Journal of Lean Six Sigma

Operational, Human resource management and External) (Almeida *et al.*, 2021; Berhe, 2022; Lameijer *et al.*, 2022). The assortment of the CFFs into five categories has been done based on their characteristics and the authors who identified them as failure factors. Figure 3 summarizes the reporting stage.

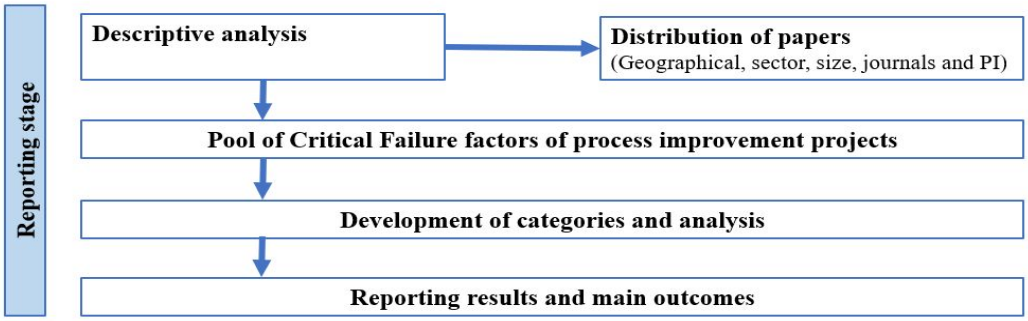

Figure 3. Flow diagram for reporting stage

3. Process Improvement Project CFFs

Rubin and Seeling, in 1967, conducted a study on project failures based on the experiences of managers, and they are credited with identifying the root causes of failure factors (Sreedharan *et al.*, 2018). Since then, researchers have widely used the term "Critical Failure Factor (CFF)" in their studies to indicate the key aspects that lead to PI project failures (Shokri *et al.*, 2022). Content analysis of the selected articles identifies 39 different failure factors in the deployment of PI projects. Thus, we grouped the CFFs into five categories: (i) management and leadership-related factors, (ii) organizational-related factors, (iii) operational-related factors, (iv) human resource management-related factors and (v) external factors. To achieve the first research objective, the remainder of this section thoroughly addresses the critical failure factors related to each category.

3.1. Factors related to management and leadership

Table shows the first cluster of factors associated with PI failure which specifically related to the role of top management. Lack of top management support, commitment and involvement was recognized as one of the most frequently cited factors contributing to the failure of PI methodologies (Almeida *et al.*, 2021; Antony and Gupta, 2019). Lack of top management support has been cited by 26 papers and reported as a

International Journal of Lean Six Sigma

common hinder for all types of PI projects, including Kaizen (Alvarado-Ramírez *et al.*, 2018), Lean, SS, LSS (McDermott *et al.*, 2022; Sreedharan *et al.*, 2018) and Agile (Chow and Cao, 2008). Hence, the absence of management involvement in each stage of the project cycle diminishes meeting the overall objective of the PI projects and leads to other issues such as cost and time overrun (Antony and Gupta, 2019). Furthermore, a deficiency of top management awareness of the need for process improvement projects and a lack of confidence in their benefits is an important failure factor (McDermott *et al.*, 2022; Sreedharan *et al.*, 2018). This implies that top management should ensure alignment between the strategic objectives of the organization and the main goal of the PI project. Indeed, a lack of interdependence between PI projects and the overall business strategy has been identified as a critical contributor that can result in failure(Marolla *et al.*, 2022; Sony *et al.*, 2019). Interesting to mention that a recent survey conducted by the project management institute (Musawir *et al.*, 2020) brought attention to those factors where only 65% of organizations have a moderate level of alignment between the project objectives and the organizational strategy while about 33% have an acceptable level of maturity in terms of realizing the expected benefits[51]. These statistics shed light on the significance of these factors and their potential contribution to project failures in real-world industries.

Numerous prior studies have recognized insufficient resources (i.e., technical, financial, human, infrastructure, data, etc) as one of the top CFFs and is identified in 18 articles on initiatives such as Kaizen (Alvarado-Ramírez *et al.*, 2018), Lean (Kinder and Burgoyne, 2013), SS (Chakravorty, 2009a) and LSS (Shokri *et al.*, 2022). It is widely acknowledged that inadequate resources during the implementation of PI projects can often be linked to a lack of support and commitment from top management (McDermott *et al.*, 2022). More importantly, selecting and prioritizing the wrong PI project can be a CFF, as argued by several authors (McDermott *et al.*, 2022; Shokri *et al.*, 2022). Often, top management selects and prioritizes PI projects rather than functional experts who understand the exact deficiencies that need improvement (Iyede *et al.*, 2018). To ensure that the right project is selected, specific guidelines and criteria should be established

International Journal of Lean Six Sigma

to enhance the benefits obtained from PI projects and satisfy organizational needs and objectives (Flifel *et al.*, 2017; Hadi-Vencheh and Yousefi, 2018).

Table 1
Management and leadership-related failure factors of PI methodologies

Failure Factor	PI practice	Sources
Lack of top management support, commitment and involvement	Kaizen, Lean, SS, LSS, Agile, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Alvarado-Ramírez *et al.*, 2018; Antony *et al.*, 2019, 2020, 2022; Antony and Gupta, 2019; Barraza *et al.*, 2009; Berhe, 2022; Chow and Cao, 2008; Iyede *et al.*, 2018; Lameijer *et al.*, 2022; Marolla *et al.*, 2022; McDermott *et al.*, 2022; Mishra *et al.*, 2021; Nwabueze, 2012; Patel and Patel, 2020; Scherrer-Rathje *et al.*, 2009; Shokri *et al.*, 2022; Soliman, 2017; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020, 2021)
Lack of alignment between strategic objectives, main goals and the PI project scope	Kaizen, Lean, SS, LSS, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Antony *et al.*, 2022; Barraza *et al.*, 2009; Berhe, 2022; Chow and Cao, 2008; Cortés Rodríguez *et al.*, 2022; Marolla *et al.*, 2022; McDermott *et al.*, 2022; Nwabueze, 2012; Secchi and Camuffo, 2019; Shokri *et al.*, 2022; Siha and Saad, 2008; Soliman, 2017; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2021)
Failure in change management	Kaizen and PI	(Almeida *et al.*, 2021; Berhe, 2022; Lameijer *et al.*, 2022)
Lack of clear vision/strategy for PI and future plans	Kaizen, SS, LSS, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Berhe, 2022; Chakravorty, 2009a; Iyede *et al.*, 2018; Lameijer *et al.*, 2022; Marolla *et al.*, 2022; Sreedharan

International Journal of Lean Six Sigma

		et al., 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020)
Lack of top management awareness about benefits expected from PI projects	SS, LSS and CI	(Albliwi *et al.*, 2014; Ambekar and Hudnurkar, 2017; Barraza *et al.*, 2009; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020)
Poor project selection	Kaizen, Lean, LSS, SS and CI	(Albliwi *et al.*, 2014; Berhe, 2022; Chakravorty, 2009a, 2009b; Hadi-Vencheh and Yousefi, 2018; Iyede *et al.*, 2018; McDermott *et al.*, 2022; Shokri *et al.*, 2022; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020)
Lack of resources	Kaizen, Lean, SS, LSS, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Alvarado-Ramírez *et al.*, 2018; Ambekar and Hudnurkar, 2017; Berhe, 2022; Chakravorty, 2009a; Iyede *et al.*, 2018; Kinder and Burgoyne, 2013; Liu *et al.*, 2015; Marolla *et al.*, 2022; McDermott *et al.*, 2022; Patel and Patel, 2020; Rotteau *et al.*, 2015; Shokri *et al.*, 2022; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020, 2021)

3.2. Organizational-related factors

Table identifies the factors contributing to the failure of PI initiatives that relate to the organization's culture, structure, size and financial concerns. Organizational culture is a set of shared practices, values, mentality and attitudes among employees at various levels and features of organizational life (Detert *et al.*, 2000). The adoption of PI projects involves a gradual change of the core habits and values of all staff in the organization toward a philosophy of continuous improvement to build a culture of trust and confidence (Albliwi *et al.*, 2014; Iyede *et al.*, 2018). Indeed, resistance to such cultural change is considered one of the top causes of failures of different PI approaches in selected 28 articles. As highlighted by Chow et al. (2007),

International Journal of Lean Six Sigma

failed PI projects, especially those involving agile methodologies, are often influenced by traditional organizational culture (Chow and Cao, 2008). Therefore, to ensure successful PI adoption, organizations should gain a thorough understanding of their cultural profiles, as recommended by Pakdil et al. (2017) (Pakdil and Leonard, 2017).

Several authors have demonstrated that the complexity due to the organizational structure has led to failure of implementing Kaizen (Barraza et al., 2011), Lean (Secchi and Camuffo, 2019) and LSS (Sreedharan *et al.*, 2018). For instance, Secchi et al. (2019) (Secchi and Camuffo, 2019) advocates that Lean projects are less likely to fail when they are characterized by the appropriate choice of organizational ambidexterity, structural or contextual, calling for more focus on contextual ambidexterity where lean tasks are not exclusively allocated for lean specialists. The decision to adopt an organizational structure involves defining new managerial roles to coordinate project teams and systematically applying process methodology (Rosa *et al.*, 2021).

Table 2
Organization-related failure factors of PI methodologies

Failure Factor	PI practice	Sources
Resistance to change	Kaizen, Lean, SS, LSS, Agile, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Alvarado-Ramírez *et al.*, 2018; Ambekar and Hudnurkar, 2017; Antony *et al.*, 2019, 2020, 2021, 2022; Antony and Gupta, 2019; Chow and Cao, 2008; Iyede *et al.*, 2018; Lameijer *et al.*, 2022; Marolla *et al.*, 2022; McDermott *et al.*, 2022; McLean and Antony, 2014; McLean *et al.*, 2017; Mishra *et al.*, 2021; Patel and Patel, 2020; Piwowar-Sulej, 2021; Rotteau *et al.*, 2015; Scherrer-Rathje *et al.*, 2009; Shokri *et al.*, 2022; Sreedharan *et al.*, 2018; Suárez-Barraza and Miguel-Davila, 2020; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020, 2021)

International Journal of Lean Six Sigma

Organizational Structure	Kaizen, Lean, LSS, PI and CI	(Lameijer *et al.*, 2022; Marolla *et al.*, 2022; Secchi and Camuffo, 2019; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011)
Financial Concerns	SS, LSS, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Berhe, 2022; Chakravorty, 2009a; Chow and Cao, 2008; Iyede *et al.*, 2018; Kuiper *et al.*, 2022; Siha and Saad, 2008; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020)
Organization size	Agile and Lean	(Chow and Cao, 2008; Mishra *et al.*, 2021; Worley and Doolen, 2015)

3.3. Operational-related factors

Operational-related CFFs of PI projects identified across the implementation stage and presented in Table . Poor project management methodologies and competencies and a lack of a strategic plan and structured project sequence to guide the implementation were recognized as the main problems of the PI methodologies (Secchi and Camuffo, 2021; Sunder M and Prashar, 2020). Furthermore, ineffective time management and lack of cost and time estimation will result in poor success rate and customer satisfaction (Sony *et al.*, 2019).

The Inefficient selection of a PI methodology and associated tools warrants the failure of PI initiatives (Antony *et al.*, 2020; Sunder M and Prashar, 2020). The proper selection and structured application of tools, processes and data is one of the primary activities at the project execution stage (Sunder M and Prashar, 2020). Hence, sufficient training should be provided to staff that can help in the proper understanding of such activities and compatible technology (Lameijer *et al.*, 2022). Misuse of statistical tools is a significant cause of failure, and having quality experts with a good understanding of statistical tools can be instrumental in effectively implementing PI and achieving sustainable results (Sreedharan *et al.*, 2018; Swarnakar *et al.*, 2020). Additionally, incorrect usage of statistical tools can lead to wrong conclusions about assumption

International Journal of Lean Six Sigma

testing, which can result in the discontinuation of the project (Sony *et al.*, 2019). Surprisingly, this factor has not been widely reported as a leading cause of failure in Six Sigma literature, despite the heavy reliance on statistical analysis. This highlights the need for further investigation to assess the significance of this failure factor.

PI methodologies also fail due to the absence of continuous monitoring and evaluation mechanisms(Chakravorty, 2009a). This can lead to a false impression of the results achieved during each stage of the implementation process (McLean *et al.*, 2017; Sreedharan *et al.*, 2018). Thus, organizations should regularly track process performance to ensure that the implementation follows the plan and continuously measure the sustainability of the results to avoid their negative impact on the continuity of the initiatives (Sony *et al.*, 2019). In addition, PI project failure can stem from a disruption in the supply chain such as long purchasing time (Berhe, 2022) and uncertainty of demand and capacity (Kinder and Burgoyne, 2013). The benefits of PI implementation should be translated to satisfy customer'' needs in terms of better products and services, leading in turn to the continuation of PI projects in the organization if the customer is satisfied (Sony *et al.*, 2019). According to (Almeida *et al.*, 2021; McDermott *et al.*, 2022; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011), a lack of understanding of customer demand can inversely influence PI performance.

Table 3
Operation-related failure factors of PI methodologies

Failure Factor	PI practice	Sources
Lack of an effective model or roadmap to guide the implementation	Kaizen, Lean, SS, LSS and CI	(Albliwi *et al.*, 2014; Berhe, 2022; Chakravorty, 2009a, 2009b; Chow and Cao, 2008; Mostafa *et al.*, 2013; Secchi and Camuffo, 2021; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020)
Poor project management	SS, LSS, Agile, PI and CI	(Albliwi *et al.*, 2014; Chow and Cao, 2008; Lameijer *et al.*, 2022; McLean and Antony, 2014; McLean *et al.*, 2017; Shokri *et al.*, 2022; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020)

International Journal of Lean Six Sigma

Lack of cost and time estimation of framework implementation	Kaizen, Lean, LSS and CI	(Albliwi *et al.*, 2014; Berhe, 2022; Iyede *et al.*, 2018; Kinder and Burgoyne, 2013; McDermott *et al.*, 2022; Sony *et al.*, 2019; Swarnakar *et al.*, 2020, 2021)
Inefficient selection of a PI methodology and associated tools/techniques	Lean, LSS, Agile, PI and CI	(Albliwi *et al.*, 2014; Antony *et al.*, 2019, 2020; Antony and Gupta, 2019; Barraza *et al.*, 2009; Chow and Cao, 2008; Kinder and Burgoyne, 2013; Marolla *et al.*, 2022; McDermott *et al.*, 2022; Nwabueze, 2012; Secchi and Camuffo, 2019; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Suárez-Barraza and Miguel-Davila, 2020; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2021)
Deficiency in proper usage of statistical tools for improvement	Kaizen, LSS and CI	(Albliwi *et al.*, 2014; Berhe, 2022; Iyede *et al.*, 2018; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Suárez-Barraza and Miguel-Davila, 2020; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020)
Lack of continuous monitoring and evaluation approach	Kaizen, Lean, SS, LSS, Agile, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Antony *et al.*, 2019; Antony and Gupta, 2019; Berhe, 2022; Chakravorty, 2009a; Chow and Cao, 2008; Iyede *et al.*, 2018; McLean *et al.*, 2017; Mostafa *et al.*, 2013; Shokri *et al.*, 2022; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011; Sunder M and Prashar, 2020)
Inadequate level of process owners engagement	LSS	(Albliwi *et al.*, 2014; Sreedharan *et al.*, 2018)
Lack of sustainability approach consideration	SS, LSS and CI	(Ambekar and Hudnurkar, 2017; Shokri *et al.*, 2022; Soliman, 2017; Sony *et al.*, 2019; Swarnakar *et al.*, 2021)
Lack of understanding about customer type and their demand	Kaizen, Lean, SS, LSS, Agile, PI and CI	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Chow and Cao, 2008; Iyede *et al.*, 2018; McDermott *et al.*, 2022; Shokri *et al.*, 2022; Siha and Saad, 2008; Sony *et al.*,

International Journal of Lean Six Sigma

		2019; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011)
Lack of knowledge codification	Lean	(Secchi and Camuffo, 2021)
Too much paperwork	Kaizen	(Suárez‐Barraza *et al.*, 2011)
Weak linking to suppliers	Kaizen, SS and LSS	(Albliwi *et al.*, 2014; Berhe, 2022; Siha and Saad, 2008; Sreedharan *et al.*, 2018)
Supply chain disruption	Kaizen, Lean, LSS and Agile	(Atari and Prause, 2019; Berhe, 2022; Chow and Cao, 2008; Kinder and Burgoyne, 2013; Kuiper *et al.*, 2022; Swarnakar *et al.*, 2020)
Inadequate level of documentation	Agile	(Chow and Cao, 2008; Maiden and Jones, n.d.)

3.4. Human resource management-related factors

Table presents the failure factors pertaining to human resources as identified in the literature. Companies have failed to adopt PI projects due to a lack of consideration of human factors (Albliwi *et al.*, 2014; Sreedharan *et al.*, 2018). An absence of a well-organized team and an inadequate composition can be critical factors that increase the risk of failure for a PI project (Almeida *et al.*, 2021). The selection of multidisciplinary and experienced teams before starting the PI project can assist in achieving the essential results (Almeida *et al.*, 2021). Lack of experience and skills related to PI implementation is another reason noticed for the failure of lean projects (Secchi and Camuffo, 2021), LSS (Sreedharan *et al.*, 2018), Kaizen (Berhe, 2022) and Agile projects (Chow and Cao, 2008). Furthermore, over 70% of PI projects have failed due to poor awareness of team member'' competencies, roles, tasks and responsibilities (Korsaa *et al.*, 2012).

In a case-based study conducted by (Secchi and Camuffo, 2019), it was found that even in the absence of all failure factors suggested by the literature, the segregation of roles between lean specialists and employees had an adverse effect on daily work and productivity goals. Employees exhibit a high level of dependency on the availability of lean experts to apply lean practices effectively. Furthermore, they expressed the perception that integrating lean principles into their work requires additional responsibilities

International Journal of Lean Six Sigma

and should be prioritized over their existing workload. This example of a failed lean project underscores the crucial need to involve all team members partly in the improvement process to increase productivity and enhance their sense of responsibility and authority to think differently. Literature presents evidence that insufficient employee engagement, lack of motivation, encouragement, and reward, lack of innovation, and inconsistent employee commitment are the crucial reasons for PI failure (Almeida *et al.*, 2021; Marolla *et al.*, 2022; Sreedharan *et al.*, 2018).

Moreover, inadequate project leadership skills at the team level can contribute to the failure of a PI deployment (Almeida *et al.*, 2021; McDermott *et al.*, 2022; Shokri *et al.*, 2022; Sunder M and Prashar, 2020). Successful implementation of PI projects mandates specific leadership competencies demonstrated during the different stages of the projects. During the pre-implementation phase, the team leader should be skilled in strategic and system thinking and client management. The deployment phase requires a highly effective clear goal, critical thinking, project management, open-mindedness and change management competencies rather than controlling and telling. Finally, team leaders must be inspirational to guide the team and create avenues to sustain outcomes from the improvement process (Motiani and Kulkarni, 2021).

Communication effectiveness has been conceptually linked to the quality of leadership skills. A central characteristic of a good leader is the ability to communicate and interact to ensure the leade''s message will be understood and acknowledged by the team (Neufeld *et al.*, 2010). To this end, another insight derived from the extant literature that is associated with a projec''s failure is related to ineffective communication among team members, leaders and strategic partners (McDermott *et al.*, 2022; Shokri *et al.*, 2022). Further, lack of collaboration (Shokri *et al.*, 2022), coordination (Swarnakar *et al.*, 2021) and teamwork (Chow and Cao, 2008) among team members is a CFF of PI projects. Apparently, lack of training stands out as the most significant factor in this category as cited in 23 articles while it holds the potential to mitigate all other contributing factors effectively. This calls for the importance of integrating adequate training programs to develop workforce skills among PI staff and pay more attention to non-technical skills such as teamwork, communication and leadership.

International Journal of Lean Six Sigma

Table 4
Human resources-related failure factors of PI methodologies

Failure Factor	PI practice	References
Deficiency in consideration of human factors	LSS	(Albliwi *et al.*, 2014; Sreedharan *et al.*, 2018; Swarnakar *et al.*, 2020)
Poor understanding of competencies, roles and responsibilities	Kaizen, Lean, LSS and Agile	(Albliwi *et al.*, 2014; Lameijer *et al.*, 2022; Liu *et al.*, 2015; Piwowar-Sulej, 2021; Secchi and Camuffo, 2019; Shokri *et al.*, 2022; Sreedharan *et al.*, 2018; Swarnakar *et al.*, 2020)
Lack of a structured team	Kaizen, Lean and LSS	(Almeida *et al.*, 2021; Antony *et al.*, 2019, 2020; Antony and Gupta, 2019; Berhe, 2022; Liu *et al.*, 2015; Mostafa *et al.*, 2013; Rotteau *et al.*, 2015; Sreedharan *et al.*, 2018; Swarnakar *et al.*, 2020)
Insufficient dedicated leadership	Lean and LSS	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Antony *et al.*, 2020, 2022; Kinder and Burgoyne, 2013; Marolla *et al.*, 2022; McDermott *et al.*, 2022; Rotteau *et al.*, 2015; Secchi and Camuffo, 2019; Shokri *et al.*, 2022; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020)
Poor communication and collaboration	Kaizen, Lean, SS, LSS and Agile	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Ambekar and Hudnurkar, 2017; Antony *et al.*, 2019, 2020, 2022; Antony and Gupta, 2019; Barraza *et al.*, 2009; Berhe, 2022; Chakravorty, 2010; Chow and Cao, 2008; Marolla *et al.*, 2022; McDermott *et al.*, 2022; Piwowar-Sulej, 2021; Scherrer-Rathje *et al.*, 2009; Shokri *et al.*, 2022; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020, 2021)
Lack of employee experience	Kaizen, Lean, LSS and Agile	(Albliwi *et al.*, 2014; Alvarado-Ramírez *et al.*, 2018; Berhe,

International Journal of Lean Six Sigma

		2022; Chakravorty, 2010; Chow and Cao, 2008; Marolla *et al.*, 2022; Patel and Patel, 2020; Secchi and Camuffo, 2021; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020)
lack of motivation, encouragement and reward	Kaizen, Lean and LSS	(Almeida *et al.*, 2021; Antony *et al.*, 2019, 2020, 2022; Antony and Gupta, 2019; Berhe, 2022; Marolla *et al.*, 2022; McLean and Antony, 2014; McLean *et al.*, 2017; Scherrer-Rathje *et al.*, 2009; Soliman, 2017; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011; Suárez-Barraza and Miguel-Davila, 2020; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020, 2021)
Lack of Employee Engagement/Participation and commitment	Kaizen, Lean and LSS	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Alvarado-Ramírez *et al.*, 2018; Antony *et al.*, 2022; Berhe, 2022; McDermott *et al.*, 2022; McLean and Antony, 2014; McLean *et al.*, 2017; Secchi and Camuffo, 2019; Sreedharan *et al.*, 2018; Suárez‐Barraza *et al.*, 2011; Sunder M and Prashar, 2020)
Lack of innovation	LSS	(Sreedharan *et al.*, 2018)
lack of training and education	Kaizen, Lean, SS and LSS	(Albliwi *et al.*, 2014; Almeida *et al.*, 2021; Ambekar and Hudnurkar, 2017; Antony *et al.*, 2019, 2020, 2022; Antony and Gupta, 2019; Berhe, 2022; Chakravorty, 2009a; Kinder and Burgoyne, 2013; Marolla *et al.*, 2022; McDermott *et al.*, 2022; McLean and Antony, 2014;

International Journal of Lean Six Sigma

		McLean *et al.*, 2017; Patel and Patel, 2020; Rotteau *et al.*, 2015; Shokri *et al.*, 2022; Soliman, 2017; Sony *et al.*, 2019; Sreedharan *et al.*, 2018; Sunder M and Prashar, 2020; Swarnakar *et al.*, 2020, 2021)
Work safety concerns	LSS and CI	(Soliman, 2017; Swarnakar *et al.*, 2021)

3.5. External Factors

This category includes the reasons that trigger the failure of PI methodologies originating from outside the organization. Among them, regulatory requirements, policies, standards and legal frameworks hinder PI deployment (Lameijer *et al.*, 2022). The findings of a survey conducted by (McDermott *et al.*, 2022) acknowledged highly regulated environment by laws, especially in the case of the healthcare sector, was one of the key factors to PI failure since it requires a high level of documentation and format and needs extra validation activities. Further, (Marolla *et al.*, 2022) believed that unclear regional policy and conflicts with worke''s unions jeopardize the implementation of PI projects.

Moreover, political instability inhibits organizations from practicing their activities, getting enough consultancy services, shortage of foreign currency and weak financial support from government forces them to freeze the PI projects (Barraza *et al.*, 2009; Berhe, 2022; Chow and Cao, 2008). Furthermore, it is not surprising that disturbances caused in demand for medical supplies due to COVID-19 spread and the global lockdown have an essential role in the failure of lean projects (Kuiper *et al.*, 2022).

4. Process Improvement Project Failures Mitigation Framework

PI implementation often brings a major organizational change starting from the top management and extending throughout all levels of employees (Mostafa *et al.*, 2013). To ensure the success of PI projects, it is vital to recognize that driving PI projects primarily emphasize promoting cultural change and implementing effective change management practices rather than focusing solely on the technical and procedural aspects (Noori and Latifi, 2018). Therefore, this paper concentrates on change due to PI

International Journal of Lean Six Sigma

implementation within an organization taking humans as a starting point for the change (Jaaron *et al.*, 2022). Indeed, the literature suggests that the active use of change management holds notable importance in avoiding project failure and maintaining a quality culture (Almanei *et al.*, 2018; Almeida *et al.*, 2021; Noori and Latifi, 2018; Sony *et al.*, 2019; Sunder M and Prashar, 2020). Hence, managers should deepen their understanding and actively employ well-known change management models such as Kotter's eight steps and ADKAR by Prosci(Hornstein, 2015).

Change management is a strategic and tactical approach used to facilitate change efforts (Lertwattanapongchai and Swierczek, 2014). It consolidates processes, tools, techniques and strategies for the successful transition toward change (Hornstein, 2015). The purpose of change management is to lead change, monitor change and help people to adapt to change to achieve the desired business outcomes (Dempsey *et al.*, 2022). The models of leading change fall into two categories; organizational focus such as Kotter and individual focus such as ADKAR (Awareness, Desire, Knowledge, Ability, Reinforcement) (Almanei *et al.*, 2018). By logically and sequentially completing each of the eight steps, Kotter's model expands the idea that leaders must create and sustain successful change. In essence, organizations can achieve successful change by mitigating the eight failure factors (Sidorko, 2008). The eight steps can be categorized into three phases: creating a climate for change before implementation (step 1-4), engaging the organization (step 5-7) and sustaining change (step 8). It emphasizes the importance of people's involvement and acceptance throughout the process (Shonhe and Grand, 2020). ADKAR starts after identifying the change and focuses on people's adaptation to accommodate change through five milestones ("ADKAR: A Model for Change in Business, Government, and Our Community - Jeff Hiatt - Google Books", 2006).The power of ADKAR model is originated from its ability to address the root cause of failure of change. Thus, it is essential to leverage the five ADKAR elements sequentially to achieve desirable outcomes (Jaaron *et al.*, 2022).

To advance further in PI failure mitigation aiming to meet our second research objective, in this study we have mapped the critical principles from Kotter and ADKAR change management models to the PI

International Journal of Lean Six Sigma

implementation that are suitable for tackling the different types of CFFs with three detailed phases (Almanei *et al.*, 2018; Carter, 2014; Santos *et al.*, 2022). The "*planning*" phase focuses on preparing for the change, the "*implementation*" phase addresses failure factors that may arise during the actual execution of PI projects and the "*sustaining the result*" phase ensures sustainable results can be achieved in PI projects. Kotter and ADKAR models complement each other by incorporating individual and organizational perspectives, creating a more holistic and integrated approach to successfully navigate and sustain improvement outcomes. Figure 4 summarizes the suggested framework.

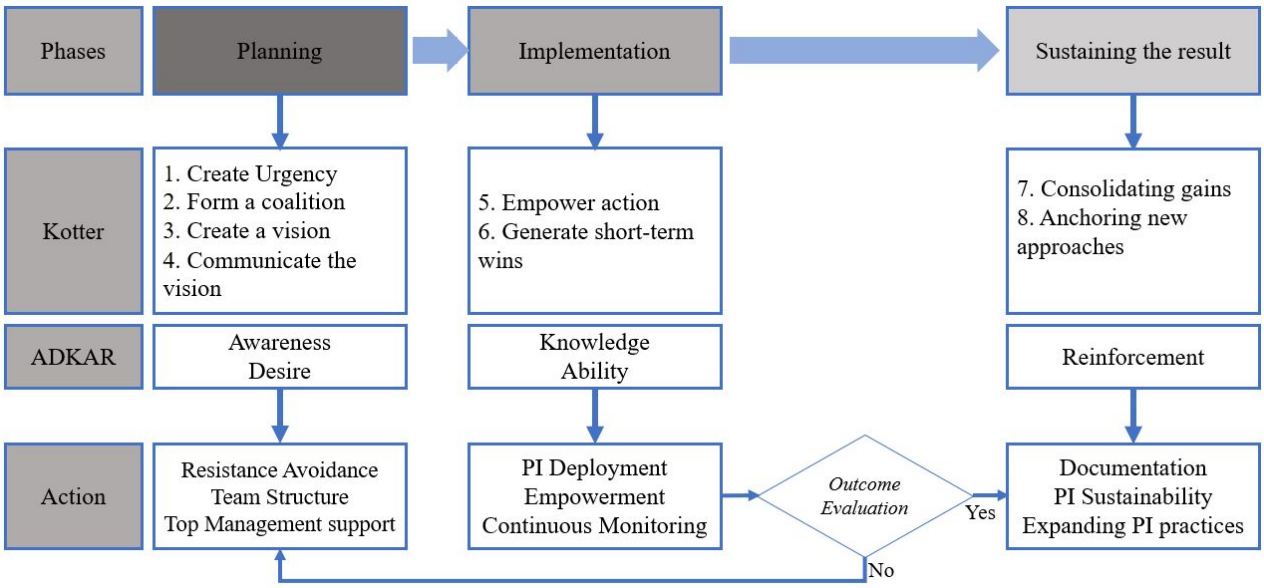

Figure 4. Proposed PI failure mitigation framework

4.1. Planning phase

This stage provides the basis for preparing the organization and people for PI adoption. When a PI project is to be implemented, people naturally resist this change because of anxiety created by ambiguity. So, individuals at different levels need to deeply recognize why the upcoming project and its consequences changes are crucial. According to Kotter model, change must be initiated only when there is a serious motivation to undergo the change(Knapp, 2015). This involves creating awareness about the current level of acceptability and carefully examining all processes, ways of thinking and behaviors. This demands a sense of urgency that conveys the needs and inspires complacency feelings. Individuals must be informed

about the immense need for PI projects, highlight the benefits and show the consequences of not implementing the project. The urgency message should be articulated by opportunities not fear-producing so that they will be confident that this project will facilitate their work and not an extra effort on top of their ordinary work (Appelbaum *et al.*, 2012). Management should recognize how the PI project is linked to customer satisfaction to meet their expectations and define the success measures (Zwikael, 2008).

On the other hand, companies have failed to adopt PI projects because of a lack of a structured team and inappropriate composition (McLean *et al.*, 2017). Kotter stressed that one person who leads the change alone, regardless of how great a leader may be, will not succeed (Sidorko, 2008). Thus, the second step recognizes the team approach and involves the careful selection of multidisciplinary teams prior to beginning the PI project in terms of complementing skills and experience which will give the project experience-sharing and assist in achieving the expected outcomes(Almeida *et al.*, 2021; Sidorko, 2008). Furthermore, the right involvement of Human resources (Green Belts/Black Belts/Master Black Belts and champions) with mapped skills versus projects to conduct Six Sigma/Lean Six Sigma projects help in making intelligent decisions and driving the change process (Snee, 2010). Additionally, Kotter calls to avoid dependency on certain project players so that left out cannot block the project execution (Appelbaum *et al.*, 2012). More importantly, this should be followed by a well-defined vision of the PI project that provides a clear picture of the needed engagement and genuinely overcomes internal barriers(Knapp, 2015; Sidorko, 2008). The final Kotter step in this phase is to communicate the vision throughout the company and involve all employees and stakeholders who would be impacted by the project implementation through inspirational channels, meetings and email updates (Butt *et al.*, 2016). To prevent resistance to change as early as possible, it is very important to integrate "*Awareness*" while communicating the vision and strategy to develop a broader understanding and explain how the PI project will benefit the organization, customers and stakeholders (Noori and Latifi, 2018). Further, changing the employee's mentality that workloads, layoffs and destroying jobs are not the intent of the PI project (Secchi and Camuffo, 2021). Moreover, the "*Desire*"

International Journal of Lean Six Sigma

element of ADKAR is essential at this stage to develop self-interest among individuals so that they will be excited about contributing to the successful implementation.

4.2. Implementation phase

This phase deals with the real deployment and execution of the PI project. In this phase, individuals utilize their experience, knowledge and skills to embrace PI on a day-to-day basis. The more people are prepared for this step, the easier it is to accomplish the goals of the project (Hwang and Low, 2012). Top management should support and monitor the application of PI initiatives. The many responsibilities of the top management role include providing resources and ongoing training while effectively managing these resources (Zwikael, 2008).

Inefficient selection of a PI methodology and associated tools that best fit the problem warrants the failure of PI initiatives. Hence, the "*Knowledge*" and "*Ability*" ADKAR elements are mandatory for the proper selection and structured application of tools, processes and data at the project execution stage(Sunder M and Prashar, 2020). Mixed feelings are expected while employees are emboldened to implement PI methodologies and many challenges can arise consequently. Accordingly, the PI deployment should be followed by the fifth Kotter step to empower the employees to act on the vision, remove obstacles and improve the system, structure and skills. Kotter stresses the pivotal role of training to create sufficient power for people who are directly involved in the project implementation and develop a sense of responsibility in a genuine motivational environment so that the project team facilitates improvement and makes necessary progress (Appelbaum *et al.*, 2012).

Furthermore, recognizing the work accomplished simultaneously acknowledging the good work and progress can fundamentally increase both management and workforce commitment toward long-term results. Some PI projects such as SS and LSS require a long time to see results (Antony *et al.*, 2021). Companies might not see wonderful results at the end of the Six Sigma/Lean Six Sigma project, but the real payback outcomes can be seen after 6-8 months. So "creating short-term wins" as suggested by Kotter is beneficial. The team can focus on easy-to-implement projects with high returns such as 5S, Value Stream

International Journal of Lean Six Sigma

Mapping and root-cause analysis, and share the gains with teams to tackle other issues and motivate them to go forward with the long-term expected improvement (Almanei *et al.*, 2018). Further, Black Belts can circulate the result obtained by the Six Sigma project from the "Define" and "Measure" phases rather than wait for the overall presumed result after the "Control" phase.

PI initiatives can also fail because of the absence of necessary continuous monitoring and evaluation mechanisms (Shokri *et al.*, 2022). This can lead to a false impression of the results achieved during each stage of the implementation process (McLean *et al.*, 2017; Sreedharan *et al.*, 2018). Thus, organizations should adopt a set of frequent assessment indicators that drive the continuous monitoring and evaluation process as proposed by Kotter and ADKAR to ensure that the implementation follows the plan, identify out-of-control variables, and recommends preventive actions against unanticipated problems(Mostafa *et al.*, 2013). Evaluation can be conducted in terms of the success matrices identified in the planning phase and the target outcomes as well as pre- and post-implementation comparison (Mostafa *et al.*, 2013). If the project fails to achieve the desired outcomes, it is advisable to conduct a project re-assessment by engaging PI professionals and carefully analyzing the underlying potential root causes.

4.3. Sustaining the results phase

More importantly, it is crucial for project leaders to build on the short-term gains to implement more complex projects and gradually engage the workforce and externals (Almanei *et al.*, 2018). Once the PI project is completed, the process owners should continuously monitor the project outcomes and understand what factors most contribute to sustaining the obtained outcomes. This is a very important phase to ensure the continuity of the PI results over time. This phase involves activities that may solidify the new process so that the modifications made during the implementation stage are fully integrated into daily activities. Management needs to integrate the chosen PI methodology into the organization's culture, ensuring that staff recognizes the PI and how they will work going forward. After the successful implementation of PI projects, organizations should continuously measure the sustainability of the results to avoid their negative impact on the continuity of the initiatives(Sony *et al.*, 2019). Thus, the "*Reinforcement*" element of the

International Journal of Lean Six Sigma

ADKAR model could be recommended to sustain the change results and thrive through performance metrics and recognition feedback from organizations (Jaaron *et al.*, 2022). This will cause positive performance sustainability and learning to overcome internal barriers.

Furthermore, Kotter emphasizes the need to institutionalize the new PI methodology as a continuous improvement way of thinking. This means embedding assessments in terms of key performance indicators such as cost reduction, resource utilization, cycle time, etc. in the organization's culture, so it becomes an integral part of its regular activities (Lee and Ahn, 2008). This will give the organizations a mechanism to track the process in an effort to guarantee the best future performance and sustainable PI projects.

5. Discussion and Conclusions

Our review of PI project failures research broadly identifies key failure factors of different PI adoptions using frequency analysis and categorizes them. To ensure transparency in the review, studies were selected from four leading academic databases. A total of 49 articles met the eligibility criteria from which we could identify 39 CFFs. Through this SLR, eight previously unreported failure factors were identified, namely "*Lack of sustainability approach consideration", "Lack of knowledge codification", "excessive paperwork", "absence of documentation", "supply chain disruption", "Lack of innovation", "work safety concerns"* and *"organization size"*.

The success or failure of a PI project is attributed to a strong and lasting organizational motivation for PI deployment. This motivation is derived from the need for PI implementation and the degree of acceptance in the organization (Lameijer *et al.*, 2021). Indeed, human resources are a very important element in the adoption of PI projects to enhance operational performance (Ahmad and Schroeder, 2003). However, the level of their adoption to change is a common issue that hinders PI continuity and contributes to failure. This was verified by the 28 articles that cited "*Resistance to change*" as a main contributor of failure. "*Lack of top management support*" was reported as a critical failure factor in 26 studies. Top management support has become even more important since the role of senior manager is characterized by the awareness of the CFFs at different organizational levels and develop a mechanism to reduce resistance to change among

International Journal of Lean Six Sigma

employees (Antony *et al.*, 2020). Also, "*lack of training*" has been cited in 23 articles indicating its criticality as well as "*communication deficiencies*" and "*lack of resources*" in 20 articles and 18 articles respectively. It is noteworthy that these factors emerge across various contexts, including manufacturing and service sectors, organizations of different sizes (small, medium, and large), as well as developed and developing countries. This indicates their criticality in contributing to failures across diverse settings. More importantly, those factors are interrelated and may reinforce each other. A lack of supportive top management can contribute to resistance to change, which can be fueled by a lack of training and poor communication. The lack of resources can absolutely hinder training programs and contribute to employee resistance as they feel unsupported to carry out their roles in the new environment.

In fact, the failure factors can be viewed as input-related factors that may influence the project implementation, but they may not have a direct impact on the project outcomes (Swarnakar *et al.*, 2021). The simultaneous involvement of several factors within the groups can give rise to new obstacles. Thus, the organizational system should have the flexibility to respond to these obstacles through a range of proactive approaches if managed well. Moreover, these obstacles have the potential to trigger additional problems during project implementation, ultimately leading to project failure (Belassi and Tukel, 1996).

While each of the PI projects possesses unique characteristics, it was determined that there are several Common CFFs shared among all PI methodologies, such as "*lack of supportive and committed top management", "resistance to culture change", "lack of a practical roadmap to guide the implementation", "lack of continuous monitoring and evaluation"* and *"communication deficiencies*". On the other hand, some other factors contribute to the failure of specific PI. "*Inadequate level of documentation*" has been reported as a failure factor of Agile but not others (Maiden and Jones, n.d.). While PI projects may place less emphasis on comprehensive documentation, Agile projects rely on proper documentation to trace the evolution of requirements, decisions, and changes (Radhakrishnan *et al.*, 2022; Zakrzewska *et al.*, 2022). It enables teams to understand why certain choices were made, track the impact of changes, and ensure accountability (Maiden and Jones, n.d.). In contrast, Kaizen projects can fail due to "*excessive paperwork*"

International Journal of Lean Six Sigma

that may hinder progress, create administrative burdens and shift the attention away from the practical implementation and finding solutions (Suárez‐Barraza *et al.*, 2011). Thus, it is imperative to find streamlined documentation to analyze data and implement change while minimizing overwhelming documentation.

Lean initiatives are more likely to fail due to the "*unacceptable level of knowledge codification*" (Secchi and Camuffo, 2021). This pertains to the program design and knowledge characteristics and transfer. Organizations planning to implement lean initiatives should prioritize using adaptable and flexible knowledge resources instead of relying solely on codified templates. This approach enables faster and more accurate knowledge transfer. By actively promoting contextual interpretation and local adaptation, organizations can engage their units effectively, leading to a comprehensive understanding of the transferred knowledge and the implementation of lean practices tailored for sustainable results (Secchi and Camuffo, 2021).

Going forward, we utilize the change management theory to propose a mitigation framework for PI project failures. While it might be difficult to make fast changes within the organizational culture to accept the PI deployment, it must be highly probable that such models have the ability to promote desired and successful project implementation. The true challenge lies not in strictly adhering to a change management model, but rather in the capacity to utilize them selectively and adaptively.

This work prepares PI professionals and decision-makers in organizations with proper project planning from the early phases and takes remedial actions to improve the sustainability of PI projects. More importantly, identifying tailored mitigation strategies enables organizations to implement targeted solutions increasing the likelihood of success. After pinpointing these reasons, additional empirical investigation can reveal the impacts of the CFFs identified in the literature and develop suitable practical mitigation strategies for their effects accordingly. Nevertheless, the scope of the paper is constrained due to a limited sample size, as it only encompassed exploration of four databases and lacks studies specifically addressing the breakdown of PI methodologies.

International Journal of Lean Six Sigma

Moreover, project failure holds significant importance, leading to a reluctance among senior managers and PI professionals to acknowledge and share their experiences of failure with researchers.

6. Future Research Directions

The third research objective sought to outline the key future research directions. In this work, we identify several significant gaps that could serve as a valuable starting point for future research. By drawing lessons from past failures, researchers can devise strategies or approaches to mitigate such failures and advance in this field. The major shortcomings identified are discussed below.

6.1. Direction 1: Bridging the expertise gap.

Future research should aim to address the limited involvement of experts in the field when studying process improvement PI project failures. To gain deeper insights into the underlying reasons for these failures, it is recommended to employ a strong research methodology that involves conducting semi-structured interviews with a diverse group of consultants and prominent PI professionals (Antony *et al.*, 2021, 2022; Berhe, 2022; McDermott *et al.*, 2022; Shokri *et al.*, 2022). Actually, the next step for our research is to develop a global empirical study to evaluate the extent to which the identified factors practically exist and lead to PI project failures. Also, while numerous publications have explored the CFFs of various PI methodologies, there remains a significant research gap regarding failure investigation in the context of Agile manufacturing. Therefore, conducting a focused investigation specifically on the failures within Agile manufacturing would be a valuable direction for future research, highlighting the distinctive challenges and opportunities within this domain. Furthermore, with the advent of digitalization and the fourth industrial revolution (I4.0), the impact of technological advancements and the integration of PI methodologies with I4.0 on the failure of PI implementations remains largely unexplored. Despite its potential significance, there is no literature addressing this research gap.

6.2. Direction 2: Commonalities and non-commonalities of CFFs

Researching and comparing the shared and distinct CFFs across various PI methodologies holds great promise as a topic of further investigation (Almeida *et al.*, 2021; McLean *et al.*, 2017; Sunder M and Prashar,

International Journal of Lean Six Sigma

2020). Additionally, investigating failure factors at different stages of PI implementation and execution, as well as differences at various organizational levels and departments, could be valuable (Ambekar and Hudnurkar, 2017; Sunder M and Prashar, 2020). Studying the common and unique failure factors in different contexts uncovers cross-challenges and enables the effective transfer of best practices. Equipped with this knowledge, organizations can develop targeted mitigation strategies and approaches that address the specific risks and challenges encountered in their respective environment. This proactive approach enhances their ability to navigate potential pitfalls, draw invaluable lessons from past mistakes, mitigate project failure and optimize desired project outcomes.

6.3. Direction 3: Exploring key failure indicators of PI projects.

It is crucial to conduct in-depth studies that investigate how organizations conceptualize and assess PI project failures, as well as the significant criteria that PI professionals and senior managers should consider in terminating a project. Filling this research gap would provide valuable insights into improving the effectiveness and success of PI initiatives, ultimately contributing to enhanced project management practices and improved organizational performance.

6.4. Direction 4: comprehensive evaluation of the consequences of PI projects failure.

Future research should prioritize the comprehensive evaluation of the consequences linked to PI failures, in terms of financial, operational, environmental, governance, and social aspects (Lameijer *et al.*, 2022). Currently, this area remains largely unexplored, indicating a need for further investigation. Conducting such research while considering perspectives from both the organization and its employees would be pivotal in advancing knowledge and promoting the sustainability of PI initiatives. By uncovering the far-reaching implications of PI failures, researchers can contribute to the development of effective strategies to minimize failure's negative impacts and optimize performance in future PI projects.

6.5. Direction 5: Developing a practical mitigation framework for PI project failures.

International Journal of Lean Six Sigma

In this work, we propose a structured framework that is expected to mitigate PI project failures. Nonetheless, it is crucial to validate this framework through conducting semi-structured interviews with subject matter experts and prominent academics in the field of Process Improvement (PI). This validation process will enable organizations aiming to ensure sustainable PI projects to leverage the framework effectively. Of utmost importance is conducting research to create a comprehensive and practical framework that integrates both the contributing failure factors and prevention practices, as well as the consequences and recovery practices (Ambekar and Hudnurkar, 2017; Antony *et al.*, 2019, 2020; Sunder M and Prashar, 2020). By doing so, business leaders will gain fresh perspectives on implementing effective mitigation strategies and remedial actions to mitigate failure risks. This, in turn, will lead to reduced adverse impacts on organizational performance, fostering improved practices that increase the likelihood of cost savings, business success, and heightened customer satisfaction.

Conflict of interest statement

The authors declare that there is no potential conflict of interest to this research or its publications.

Declaration of Generative AI and AI-assisted technologies

During the preparation and review of this work, the author(s) used ChatGPT in order to improve readability and language. After using this tool, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication.

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