Measuring the readiness level for Kaizen projects

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Measuring the readiness level for Kaizen projects: A multi-layer Bayesian decision-making framework

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Abstract

Purpose. Acquainting organisations regarding the concepts of Total Quality Management (TQM) and its implementation is one measure that effectively improves their global position and performance. Kaizen is one of the concepts of TQM, which focuses on low-cost organisational transformational methods and often saves consuming significant resources (time, capital, etc.). Using Kaizen in organisational transformation sets efficient guidelines to improve processes agility and leanness and increase manufacturing productivity. Hence, this study aims to identify the key success factors in Kaizen projects and presents a score function that measures the readiness level of organisations to implement Kaizen projects.

Design. A literature review first extracts the key success factors in Kaizen projects. Afterwards, the selected factors are screened via the Fuzzy Delphi method using expert opinions from the manufacturing sector of an emerging economy. Subsequently, their importance is cross-examined by the Bayesian Best-Worst Method (BBWM). The BBWM is one of the most recent Multiple-Criteria Decision-Making (MCDM) methods that lead to stable, dynamic and robust pairwise comparisons. After analysing the weights of the key factors, a score function is designed so that organisations can understand how much they are ready to launch Kaizen projects.

Findings. According to the findings, "Training and Education" and "Employee attitude" played an important role in the success of Kaizen projects. The literature extracted 22 success factors of Kaizen projects, and ten factors were eliminated through the fuzzy Delphi method. Twelve success factors in Kaizen projects were evaluated and investigated through the BBWM. Matching to this method, "Training and Education" and "Employee attitude" weighed 0.119 and 0.112, relatively. Furthermore, "Support from senior management" was the least important factor.

Originality. To the best knowledge of the authors, this is the first research in which the success factors of Kaizen projects have been identified and analysed through an integrated multi-layer decision-making framework. Although some studies have investigated the key success factors of Kaizen projects and analysed them through statistical approaches, research that examines the success factors of Kaizen projects through MCDM methods is yet to be reported. Moreover, the score function that measures the level of readiness of each organisation for the successful implementation of Kaizen projects is a unique contribution to this research.

Keywords. Kaizen, TQM, Bayesian Best-Worst Method, Multiple-Criteria Decision-Making

1. Introduction

Kaizen is a Japanese term that means "continuous improvement" and is recognised as a comprehensive quality management approach adopted in most service, commercial and manufacturing industries. This approach eventuates reduced waste in processes and energy consumption and, as a result, increases industries profits (Androniceanu et al., 2023). Kaizen consists of innovative, small and incremental activities that employees carry out, leading to continuous improvement over time, thereby achieving competitiveness (Kharub et al., 2023). In other words, Kaizen creates small and continuous changes over time, which leads to process improvement and the elimination of waste over time, thus enhancing sustainability in processes and businesses (Flug et al., 2022).

Another reason for the importance of Kaizen is that it increases employee participation in Kaizen projects. Kaizen develops employees capabilities to eliminate unnecessary work and waste in processes and identify new opportunities. These processes continuously enhance human resources (HR) skills. By acquiring skills from the Kaizen process, HR solves minor problems by eliminating unnecessary processes (waste) and making significant progress toward the organisational goals (Minh and Quyen, 2022). Furthermore, Kaizen encourages more independence of employees, makes them participate in every part of the processes, and increases their skills in problem-solving activities. Therefore, Kaizen results in higher satisfaction, improved skills, and increased productivity and competence (Kharub et al., 2023). Considering the potential of Kaizen on employees productivity, the efficiency and effectiveness of organisational processes are expected to improve, and as a result, profit increases (Otsuka and Ben-Mazwi, 2022).

Maintaining competitive advantage and achieving efficiency and effectiveness have caused organisations to be challenged from different directions. Therefore, organisations must have a philosophy that leads to continuous improvement and achieves higher efficiency and effectiveness in the long term (Kharub et al., 2023). Although some organisations increase efficiency, effectiveness, and competitive advantage through innovation in their processes (Siew Mui et al., 2022), many pieces of research revealed that huge investments in innovation and technology impact efficiency and effectiveness only for a while (Alosani and Al-Dhaafri, 2022). Hence, organisations need Kaizen approaches to overcome this challenge to avoid wasting resources and maintain a competitive advantage (Siew Mui et al., 2022). Moreover, researchers have concluded that Kaizen is one of the simplest and most continuous methods that are cost-effective, uses minimal resources, and helps organisations reach their goals in the long term, leading to a sustainable competitive advantage (Alosani and Al-Dhaafri, 2022).

The importance and high potential of Kaizen have contributed it to being implemented in various industries. Androniceanu et al. (2023) used Kaizen to save energy consumption in the production sector and found that 20% of energy was reduced. Implementing Kaizen in Ethiopian industries achieved monetary, nonmonetary, and qualitative results (Berhe, 2022). According to Alosani and Al-Dhaafri (2022), Kaizen increased the performance of the police force in the UAE. Ishijima et al. (2022) revealed that implementing Kaizen in public hospitals in Tanzania reduced the improper segregation of hospital waste. Furthermore, in the academic

sector, Kaizen has attracted the attention of researchers. Kharub et al. (2023) investigated the relationship between the performance of supervisors behaviour and the success of Kaizen events. Moreover, Jones et al. (2022) found that Kaizen events lead to coordination of project teams. Previously, Moi and Sing (2021) provided an operational framework consisting of Kaizen, Kaikaku, and 5S.

According to the literature, research in the field of Kaizen is increasing, and this approach is fundamental for process excellence. Hence, this study intends to investigate this field and specifically examine the critical success factors of Kaizen projects. The critical success factors of Kaizen are vital for organisations long-term success and significantly contribute to achieving efficiency and effectiveness and maintaining a competitive advantage (Jones et al., 2022). Some studies have identified the critical success factors of Kaizen and evaluated these factors through different techniques. Nonetheless, in addition to identifying the success factors of Kaizen projects, the issue of the level of readiness of organisations to implement these factors has been raised. In other words, *what is the level of organisations readiness to adopt and implement Kaizen projects?* The response to this question is decisive as organisations will face crucial challenges, leading to the failure of Kaizen projects and a waste of resources and time. Considering the importance of organisations readiness to implement Kaizen projects, research that investigates organisational preparedness in this regard is yet to be reported. Therefore, to fill this gap, this study aims to provide a practical score function to ensure that organisations are aware of their readiness before implementing Kaizen projects. To achieve this, (i) key success factors in Kaizen projects are analysed by reviewing the existing literature; (ii) extracted factors are screened through the Fuzzy Delphi method using expert opinions; (iii) selected critical factors are analysed through the Bayesian Best-Worst Method (BBWM); and (iv) eventually, a score function that denotes the level of readiness of organisations toward implementing Kaizen projects is proposed.

In the subsequent sections of this paper, the research conducted in the field of Kaizen is discussed, and the key success factors that play a significant role in Kaizen projects are determined. Section 3 introduces expert qualifications and selection, data gathering, Fuzzy Delphi, and BBWM. The results of the Fuzzy Delphi method and the BBWM are presented in section 4. The discussion and implication are presented in section 5, and the conclusion, limitations, and future suggestions are presented in the last section.

2. Literature Review

Kaizen was first developed by Iami in 1986 at Toyota and was used to improve efficiency, productivity, and competitiveness with the participation of employees. Kaizen is also used in daily life, including personal, social, and professional roles (Androniceanu et al., 2023). In the West, Kaizen has been translated into "continuous improvement" (Berhe, 2022). It consists of three principles; (i) process orientation (emphasises that the focus of management should be on improving procedures so that acceptable results are inevitably obtained), (ii) improvement and maintenance standards (innovation in organisations require a long-term and continuous effort and to maintain and increase the performance levels in a completely standard manner),

and (iii) people-oriented (refers to the participation of all members of an organisation) (Kharub et al., 2023).

Many researchers believe that organisational processes can be continuously improved through simple and effective methods in Kaizen (Alosani & Al-Dhaafri, 2022). Through the application of Kaizen, wastage in any organisation is identifiable, and energy consumption is reduced. Another reason for using Kaizen is to replace and improve types of equipment that consume a high energy rate (Androniceanu et al., 2023). Furthermore, it increases success and reduces failure in organisational projects (Al-Hyari et al., 2019). Among the factors that contribute to the success of Kaizen projects are the appropriate organisational culture and structure (Androniceanu et al., 2023; Siew Mui et al., 2022), leadership (Gastelum-Acosta et al., 2022; Berhe, 2022; Flug et al., 2022b), and process standardisation (Moi & Sing, 2021; Omotayo et al., 2018; García et al., 2014).

Key success factors of Kaizen projects were extracted through the literature review of the last eleven years. The literature review in this paper included papers from 2013 until the end of March 2023 that were identified in Google Scholar, Web of Science and Scopus databases. The search was performed in Web of Science databases to ensure the most accurate results. It was formulated as "TITLE-ABS-KEY(("Kaizen" OR "Kaizen projects" OR "Kaizen events") AND "Key success factors") AND (DOCTYPE(ar) AND NOT DOCTYPE(bk) AND NOT DOCTYPE(cp) AND NOT DOCTYPE(ed)) AND (LANG(English)) AND (PUBYEAR AFT 2013 AND PUBYEAR BEF 2024)". Moreover, this process was replicated for Google Scholar and Scopus using the search terms "("Kaizen" OR "Kaizen Project" OR "Kaizen Application") AND "Key success factors" after 2013 before 2024". The analysis involved excluding non-academic sources, such as conference papers and editorials, to achieve the most robust outcomes.

The aim of the previous studies, the research methods applied, and the result of the studies are specified in Table 1. Various researchers have investigated the field of Kaizen. For instance, Kharub et al. (2023) identified the effective factors for Kaizen events in research projects. Using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), the study determined that the work-study, human resource performance and supervisors behaviour directly influence Kaizen's success. Furthermore, Androniceanu et al. (2023) employed the Kaizen approach to reduce energy consumption without changing the technological process. Moreover, Ishijima et al. (2022) applied a 5S (Sort, Straighten, Shine, Standardise, and Sustain)-KAIZEN-TQM framework to improve hospitals waste management. More recently, Alosani and Al-Dhaafri (2022) investigated the relationship between Kaizen and police performance in the UAE. Similarly, Jones et al. (2022) addressed a process and project improvement using Kaizen events (see Table 1 for further details).

---------- Insert table 1 here ----------

According to Table 1, the key success factors of Kaizen projects were extracted. The literature review conducted in this study denoted that 22 key success factors influence Kaizen projects.

Table 2 presents the key success factors of Kaizen, which served as fundamental factors for further analyses in this study.

---------- Insert Table 2 here ----------

According to Table 1, some studies identified the success factors of Kaizen projects. Kharub et al. (2023) identified the effective factors in completing Kaizen projects and analysed them using statistical methods. Gonzalez-Aleu et al. (2018) identified the critical factors of Kaizen projects using a retrospective review (see Table 1). Despite the research studies on the key success factors of Kaizen projects and their analysis, to the best knowledge of the authors, no study has measured and presented a score function for organisations readiness to implement Kaizen projects. To fill this gap, this study provides a score function using the key success factors for successfully conducting Kaizen projects. Organisations can use the suggested score function to determine their readiness to start Kaizen projects, achieve efficiency and effectiveness, and avoid wasting time and resources.

3. Methodology

The literature revealed the importance of Kaizen for organisations. The current study intends to provide a score function according to the critical success factors so that organisations will be aware of their readiness to conduct Kaizen projects. In case an organisation is not properly informed regarding its readiness level, it will face critical challenges in implementing Kaizen projects, wasting capital and time. Therefore, this research encompasses (i) identifying key success factors in Kaizen projects; (ii) screening the initial list of Kaizen success factors through the Fuzzy Delphi method; (iii) analysing the screened list via the BBWM; and (iv) finally providing a score function to measure the readiness level of organisations in Kaizen projects. A mixed method, including a Literature Review (qualitative research) and a multi-layer multi-criteria decision-making (MCDM) approach (quantitative research), was designed and applied to achieve these goals. The general framework of this research is presented in Figure 1 and described below.

---------- Insert figure 1 here ----------

Initialisation Phase. A literature review extracted the initial list of success factors for Kaizen projects. Based on the literature review and searching in some databases (e.g., Google Scholar, Web of Science, Scopus, etc.) during 2013-2023, twenty-two success factors of Kaizen projects were extracted and listed. Subsequently, judgmental sampling was used to identify experts. This sampling is useful in multi-criteria decision-making studies and is also applied in qualitative studies and expert interviews (Müller-Trede, 2011). In this type of sampling, the qualifications for selecting experts must be determined first. This study considered relevant experts to analyse these factors based on the following criteria.

1. Familiarity with relevant concepts and Kaizen projects;
2. Willingness to participate in the research and available to complete the BBWM questionnaire (at least four hours accessibility);
3. Having at least three years of experience in implementing Kaizen projects; and

4. Having a bachelor's degree in business and management, industrial engineering, or other similar qualifications.

According to the relevant qualifications, the experts of this study were identified and divided into three panels. The expert panel created ideal gatherings for in-depth discussions and debates and more consistent results. Moreover, the qualifications of an academic member for each panel included namely: (i) having at least a lecturer position at a university and (ii) having published at least five journal articles in Kaizen in the last five years. These academics participated in each panel to determine the research objectives and methodology and how to complete the questionnaire. The specifications of the experts are listed in Table 3.

---------- Insert table 3 here ----------

Selection Phase. The fuzzy Delphi technique was applied to analyse and screen the success factors of Kaizen projects. The fuzzy Delphi technique was introduced in 1963 by a research and development company, since then, has been widely employed in many areas (Amoozad Mahdiraji et al., 2022). After identifying the initial list of success factors of Kaizen projects through a literature review and access to 15 experts, a fuzzy Delphi questionnaire was designed and completed in two rounds by experts through linguistic variables. These linguistic terms were converted into triangular fuzzy numbers (TFNs) through Table 4. Before sending the fuzzy Delphi questionnaire, a group briefing session (30 minutes) was held for each panel of experts. The purpose of the research and how to complete the questionnaires were explained to them. Furthermore, an academic participated in each panel as a liaison to answer the experts' questions.

---------- Insert table 4 here ----------

After completing the questionnaire by the panel of experts, Eq. 1 was employed to measure the success factors of Kaizen projects. Note that $\widetilde{AFV_j}$ is the aggregated fuzzy value of the jth factor, and $\widetilde{D_j^k}$ is the kth expert's fuzzy assessment of the jth factor. Where $\widetilde{D_j^K} = \left(a_j^k, m_j^k, b_j^k\right)$ is a TFN for $j = \{1, 2, ..., 3, n\}$ and $k = \{1, 2, ..., 3, L\}$. Subsequently, the defuzzied value for each factor was measured by Eq. 2 (Amoozad Mahdiraji et al., 2023)

$$\widetilde{AFV_j} = \left(a_j, m_j, b_j\right) = \left(min\ D_j^k, \prod_{k=1}^{L} D_j^k, max\ D_j^k\right) \quad (1)$$

.

$$DF_j = a_j + \frac{(b_j - a_j) + (m_j - a_j)}{3}, \qquad \forall_j \epsilon n \quad (2)$$

In this study, the described process was repeated twice, and if the difference between the two rounds was less than 0.2, the process was stopped, and the factor was selected for the average scores above 0.7 (Amoozad Mahdiraji et al., 2023). After screening the success factors, the finalised factors were weighted by the BBWM. A relevant BBWM questionnaire was designed and circulated amongst the experts. Similar to the previous data-gathering stage, a briefing session was set regarding how to complete the BBWM questionnaire with the academic liaison

for each panel. The BBWM questionnaires were distributed among the experts and were completed and collated after two hours.

Analysis Phase. MCDM methods are widely used to obtain the degree of importance of factors and to provide a score function. There are various methods in MCDM, but this study employed the BBWM for measuring the importance of the Kaizen project success factors. The main problem with other MCDM methods is that many pairwise comparisons are required, sometimes making data collection difficult. In the best–worst method (BWM), it is enough to compare the factors with the best factor and worst. The BBWM is an extended version of the BWM coined by Rezaei in 2015. The advantages of this method include (i) a small number of paired comparisons and (ii) providing reliable results. In the BWM, arithmetic or geometric averages integrate the experts preferences. To solve this problem, Mohammadi and Rezaei (2020) presented the BBWM. The main advantage of this method is that it provides a confidence level of group preferences of experts in a Bayesian form. Knowing the group preferences of experts leads to confident and accurate decision-making by managers (Rezaei, 2015; Mohammadi and Rezaei, 2020). Hence, it has been used in this study.

So far, the BBWM has been used in various fields, including lean manufacturing (Debnath et al., 2023), resilience (Khan et al., 2022), closed-loop supply chain (Kelly et al., 2022), and supply chain risk analysis (Liu et al., 2021). The initial steps of BBWM include (i) identifying the success factors of Kaizen projects, (ii) identifying the best (most important) and worst (least important) factors based on a panel of experts opinions, (iii) comparing the best factor with other factors by BBWM questionnaire, and (iv) comparing other factors with the worst factor by the BBWM questionnaire (on a Likert scale from 1 to 9). Next, a decision posterior distribution should be formed as $P(W^{agg}, W^{1:K}|A_B^{1:K}, A_W^{1:K})$. Where $A_B^{1:K}$ is the weight of the best factor from the kth expert, $A_W^{1:K}$ is the weight of the worst factor from the kth expert, and W^{agg} is the optimal weight. If $P(W^{agg}, W^{1:K}|A_B^{1:K}, A_W^{1:K})$ is measured, the criterion probability of each expert through $(X) = \sum_y P(x, y)$ is obtained where x and y are random variables. Under these conditions, the optimal group weight W^{agg}, which depends on the optimal weight of each expert (W^K), is obtained from $P(A_W^K|W^{agg}, W^K) = P(A_W^K, |W^K)$ (Mohammadi and Rezaei, 2020). Considering all the independent variables and Bayes theorem, Eq. 3 calculates the joint posterior distribution (Liu et al., 2021).

$$P(W^{agg}, W^{1:K}|A_B^{1:K}, A_W^{1:K}) \propto P(A_B^{1:K}, A_W^{1:K}|W^{agg}, W^{1:K})P(W^{agg}, W^{1:K}) = P(W^{agg}) \prod_{k=1}^{k} P\,(A_W^K|W^K)P(A_B^K|W^K)P(W^K|W^{agg}) \quad (3)$$

Eq. 3 creates a hierarchical model through a chain between different parameters. Nonetheless, the distribution of each element has not been specified, and to maintain the idea of the BWM, it is modelled according to Eq. 4 (Ayyildiz and Erdogan, 2022).

$$PA_B^K|W^K \sim multinomial(1/W^K), \qquad \forall k = 1, \dots, K, \quad (4)$$

$$A_W^K|W^K \sim multinomial(W^K), \qquad \forall k = 1, \dots, K$$

In Eq. 4, the value of W^K is in the vicinity of W^{agg}, so the Dirichlet distribution can be modelled through the optimal group weight W^{agg} depending on the optimal weight of each expert W^K, in the form of Eq. 5. Where W^{agg} is equal to with mean distribution, and γ is a non-negative parameter (Debnath et al., 2023).

$$W^K|W^{agg} \sim Dir(\gamma \times W^{agg}), \qquad \forall k = 1, \dots, K \tag{5}$$

It is clear that in Eq. 5, the mean distribution of the non-negative parameter γ is controlled, so the weight W^K should be close to W^{agg}. In this case, the gamma distribution follows the relation $\gamma \sim gamma(a, b)$, where a and b are the shape and scale of the distribution parameter. To obtain W^{agg}, the ignorance of the Dirichlet distribution with parameter a=1 should be used, which in this case, is $W^{agg} \sim Dir(a)$. According to the presented model, the Markov-chain Monte Carlo (MCMC) should be used to calculate the posterior distribution. The sampling in MCMC is obtained from Eq. 3 (Mohammadi and Rezaei, 2020). The credal ranking is used to calibrate the degree of superiority of one criterion over the other to develop the Bayesian model. The credal ranking is calculated based on the Dirichlet W^{agg} distribution, this type of rating is used in this method. The conceptualisation of credal ranking is shown in the form of Eq. 6, where $d \in [0,1]$ indicates the reliability of relationships. A credal ranking for all criteria is a set of credit rankings that includes the conjugate criteria (C_i, C_j) for all $C_i, C_j \in C$ (Mohammadi and Rezaei, 2020).

$$O = (C_i, C_j, R, d) \quad where \quad R <=> C_i, C_j \quad , \quad \mathrm{d} \in [0,1] \tag{6}$$

For the confidence level of credal ranking that C_i is better than C_j, W^{agg}'s posterior probability distribution is used as follows (Liu et al., 2021).

$$P(c_i > c_j) = \int I_{(W_i^{agg} > W_j^{agg})} P(W^{agg}) \tag{7}$$

W^{aggq} is equal to the q[th] sample of W^{agg} from the MCMC in Eq. 7, and W^{agg} is the group weight of the operator. $P(W^{agg})$is the posterior probability of W^{agg}, and I is the condition parameter. To calculate the I parameter, the conditions $W_i^{aggq} > W_j^{aggq}$ and $W_j^{aggq} > W_i^{aggq}$ must be met. Otherwise, the value of I is zero. The confidence level is obtained by calculating (Q) in the posterior distribution from the following relationship. Under these conditions, confidence in the superiority of one over the other for each pair of criteria is obtained (Mohammadi and Rezaei, 2020).

$$P(c_j > c_i) = \frac{1}{Q} \sum_{Q=1}^{Q} I\left(W_j^{aggq} > W_i^{aggq}\right) \tag{8}$$

$$P(c_i > c_j) = \frac{1}{Q} Q = 1 QI(W_i^{aggq} > W_j^{aggq})$$

If instead of credal ranking, common ranking is employed $P(c_i > c_j) + P(c_j > c_i) = 1$. Therefore, when $P(c_i > c_j) > 0.5$, C_i is more important than C_j factor, and by applying a threshold of 0.5, a credal ranking can be achieved for each criterion (Mohammadi and Rezaei, 2020). Ultimately, a score function was presented to measure an organisation's readiness level to implement Kaizen projects according to the following Eq.9.

$$\sum_{j=1}^{n} W_j \times T_j \tag{9}$$

4. Results

Experts opinions were collected after extracting 22 success factors in implementing Kaizen projects from the literature review and using the fuzzy Delphi questionnaire. The fuzzy Delphi results are presented in Table 5. Note that this process was stopped after two rounds as the required consistency was obtained in the opinion of experts by achieving the required difference between the two rounds (less than 10%). Furthermore, the acceptance threshold was set at 0.7 to select the most prominent factors (last column).

---------- Insert table 5 here ----------

The fuzzy Delphi method was analysed using Excel software. Consequently, the factors of leadership, relationship management, management understanding of continuous improvement, contract documentation and procurement, allocated resources, using an appropriate methodology, presence of a facilitator to support the program, interdepartmental communication, differences between the focus on improvement and the existing culture, and software were removed. By selecting twelve success factors (see Table 6) from the initial list, the BBWM was used. In this regard, the experts completed the BBWM questionnaire, and the weights of each of the success factors of Kaizen projects were obtained.

---------- Insert table 6 here ----------

Table 7 compares Kaizen projects best and worst success factors to other factors. For instance, in panel 2, the best factor (most important factor) was Training and education (SF_{10}) and the worst factor (least important factor) was the organisation of support teams (SF_8). The value of 9 in this column indicates that Training and education (SF_{10}) is nine times more preferable than this factor. Furthermore, in panel 3, the best factor was Employee attitude (SF_9), and the worst factor in this panel was Support from senior management (SF_4). The value of 6 in this column indicates that Employee attitude (SF_9) was six times more preferable than this factor. In the same way, all pairwise comparisons were completed, and by using MATLAB software, the results were emanated.

---------- Insert table 7 here ----------

After data analysis and coding in MATLAB software, the weight of each success factor of Kaizen projects was obtained as Table 8, where Training and education (SF_{10}) and Support

from senior management (SF_4) were identified as the most important and the least important factor, relatively.

---------- Insert table 8 here ----------

After obtaining the final weights, a confidence level of the group preferences of experts was presented in a Bayesian form (Figure 2). As mentioned earlier, the preferences of the expert group lead to better organisational decision-making. In Figure 2, the success factors of Kaizen projects were displayed from top to bottom (most to least important). The values on the lines indicate the priority of the success factor over the destination. For instance, Training and Education (SF_{10}), compared to Support from senior management (SF_4), had a credal ranking of 100%, which reveals that all experts agreed on the superiority of education over support teams. As can be seen, each factor has several outgoing edges, and they can be used to infer the influence and power of the success factors of Kaizen projects. As a result, the bottom factors with the most incoming links have less weight and are heavily influenced by those at the top.

---------- Insert figure 2 here ----------

Figure 2 illustrates the most and least important preferences of the experts. Therefore, in this study, to determine the important preferences of experts, different threshold values were implemented on the model to determine the crucial relationships between the success factors of Kaizen projects. As a result, considering the threshold of 0.75 (75%), the credal ranking was obtained according to Figure 3. This figure demonstrates the vital relationships and supports organisations in comprehending the fundamentals of Kaizen projects. In this way, managers prioritise imperative factors and use them in their strategic decisions.

---------- Insert figure 3 here ----------

5. Discussion and Implications

The diagram of this study was drawn based on the ranking of the success factors of Kaizen projects, as shown in Table 8 and based on the experts opinions in Table 7. This graph denotes that the importance of the factors decreases as you move down the graph. Furthermore, each agent has several outgoing edges displayed with a number. These numbers indicate the certainty of the influence of the source factor on the destination node. These connections can be used to infer the influence and power of influential factors for the success of Kaizen projects. Therefore, the less important factors at the bottom have more incoming links, which reveals that the top factors strongly influence these factors. Regarding the number of outgoing edges, training and education (SF_{10}) and employee attitude (SF_9) greatly influence other factors. As a result, factors such as commitment and motivation of staff (SF_7) and Support from senior management (SF_4) were influenced by training and practice and the attitude of employees.

Figure 4 illustrates that the training, education, and employee attitude are almost at the same level. Similarly, Alosani and Al-Dhaafri (2022) showed that training and education, as background factor, affects the ability to carry out Kaizen projects. Dang-Pham et al. (2022) stated that training and education are important factors in identifying problems earlier and

improving organisational efficiency. Gastelum-Acosta et al. (2022) investigated that employee attitude plays an important role in accepting training and changing culture and helps to develop the project. Moi and Sing (2021) introduced training and education as an important factor in industrial operations. According to Figure 4, it can be concluded that other factors are also influenced by training and education and employee attitude. Therefore, it is recommended that future researchers study the challenges of training and education and employee attitudes toward the development of Kaizen projects.

---------- Insert figure 4 here ----------

This study evaluated the readiness level of organisations to implement Kaizen projects. Determining the level of readiness of organisations requires the examination of various situations. Hence, a principle based on the Kaizen Projects Readiness (KPR) was expected. According to the literature and the best knowledge of the authors, no research has been reported in this regard. Therefore, a level-based KPR was presented. This level-based approach starts by observing the basic principles of Kaizen (KPR_1) and continues until organisations have reached a full readiness to implement Kaizen projects (KPR5) successfully. In KPR_1, organisations need more preparation to implement Kaizen projects (decision stage). More attention should be paid to training, education, and employee attitude at this level, according to the results of BBWM. In KPR_2, organisations have adopted managerial-level decisions and defined organisational goals and strategies; nevertheless, they have yet to enter the operational step. To pass this level, in addition to paying attention to training and education and employee attitude, it is recommended that organisations consider setting goals for improvement programs and developing a culture of continuous improvement. In KPR_3, organisations are in a relatively appropriate position and can achieve the primary operational goals and improve and develop their operations by considering the key success factors. In KPR_4, organisations have completely left the initial stages and entered the operational phase; hence, they can achieve more effectiveness and efficiency. In KPR_5, organisations are fully prepared to implement Kaizen projects and must further monitor and pursue continuous improvement through key success factors. These levels are specified in Table 9.

---------- Insert table 9 here ----------

After establishing the organisational readiness level to implement Kaizen projects, the organisational readiness score (X) is obtained through a simple additive weight (SAW) method via $\sum_{j=1}^{n} W_j \times T_j$. This approach paves the way for the implementation of Kaizen projects in organisations as it (i) informs managers about the current status of their organisation to implement the Kaizen project, (ii) help managers make the right decisions and adopt suitable policies by being aware of their readiness level to implement Kaizen projects.

6. Conclusions

This study evaluated the key success factors of Kaizen projects and examined the level of readiness of organisations to implement Kaizen projects using industry and academic experts. To achieve this goal, the success factors of Kaizen projects were determined through a literature review. To screen these factors, the fuzzy Delphi method was used. Afterwards, the BBWM

was applied to weigh the screened factors. According to this method, employee attitude was the most important, and the support team was the least important factor. In the end, a score function was presented to check organisations readiness to implement Kaizen projects.

This study employed a literature review and hybrid fuzzy Delphi-BBWM to illustrate how Kaizen success factors can add value to organisations. To improve information-gathering and text-mining capabilities in the literature review section, researchers can employ advanced techniques such as Hierarchical Dirichlet Processes (HDPs), Latent Semantic Analysis (LSA), and Random Projection (RP). This study ignored empirical evidence of organisations readiness for Kaizen projects. The authors recommended a surface-based scoring approach, as described in Table 9, to test the recommended framework in the real world. Moreover, in the future, researchers can provide empirical evidence regarding the success factors of Kaizen projects in organisations by using the score function and examining it in organisations, accurately evaluating the performance of the score function, and criticising the suggested score function.

Furthermore, in this research, the authors employed Fuzzy Delphi and Beysian BWM to include the uncertainty of the environment in their analysis. Nonetheless, researchers can benefit from more advanced uncertainty approaches such as Intuitionistic fuzzy (IF), Fermatean Fuzzy (FF), and Hesitant Fuzzy (FF). Moreover, the authors applied BWM as one of the most popular methods to measure the importance of the success factors. Nevertheless, other weighting methods such as Step-Wise Weight Assessment Ratio Analysis (SWARA), Multi-Objective Optimization based on Ratio Analysis (MOORA), Elimination et Choice Translating Reality (ELECTRE), etc., could have been used and benchmarked with the results of the current study. Eventually, researchers can benefit from Interpretive Structural Modelling (ISM), Fuzzy Cognitive Mapping (FCM), etc., to examine the type of success factors and also measure how they impact each other.

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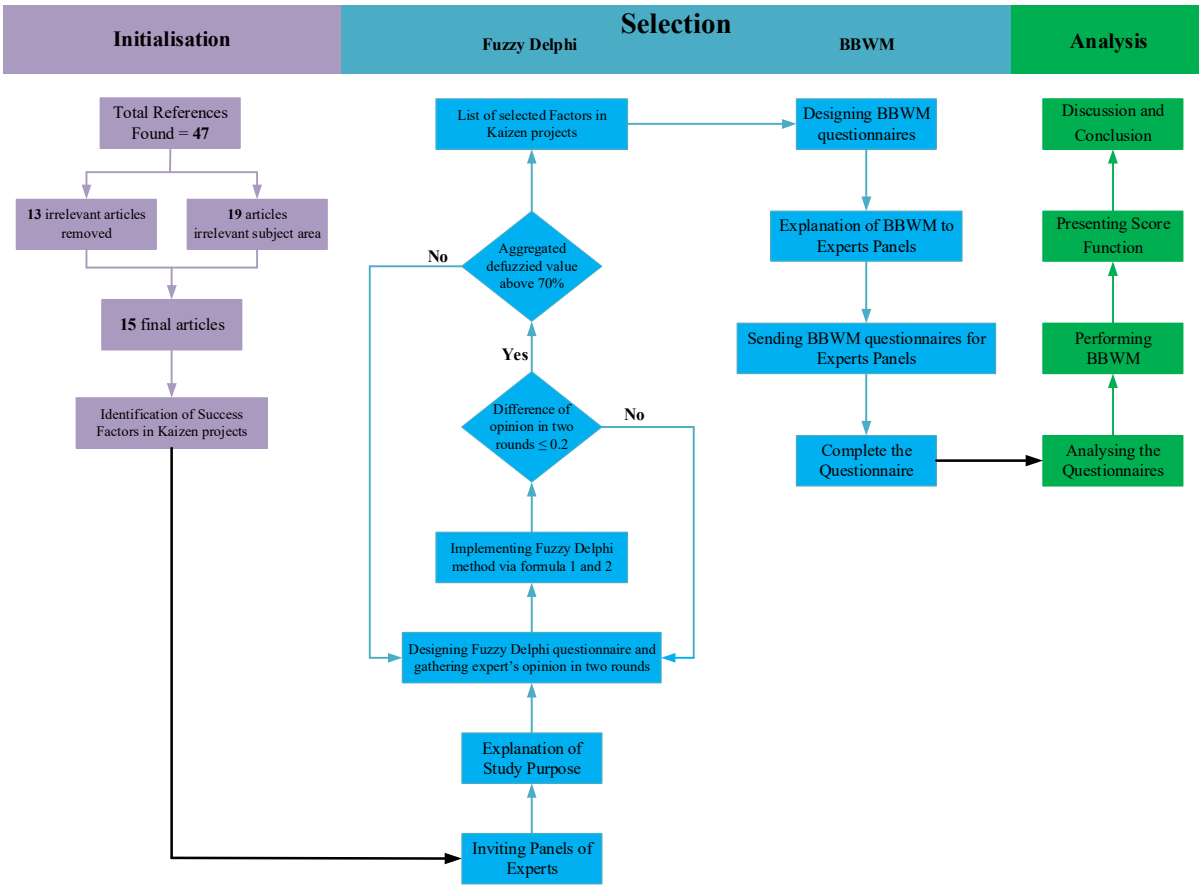

Figure 1. Research framework (source: created by the authors)

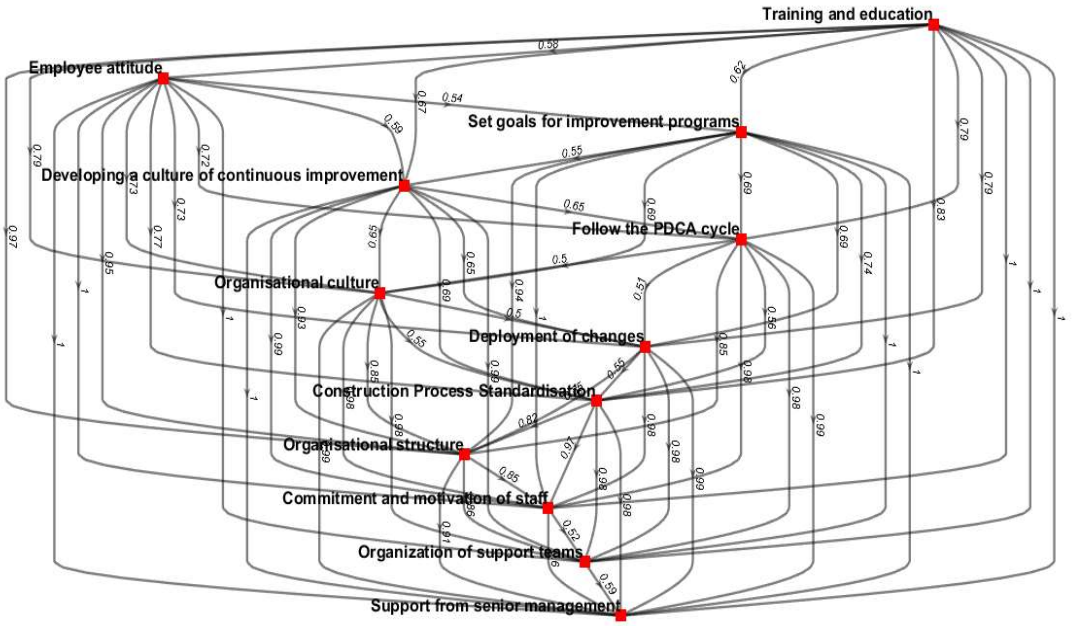

Figure 2. The visualisation of the credal ranking for Success factors of Kaizen projects (source: created by the authors)

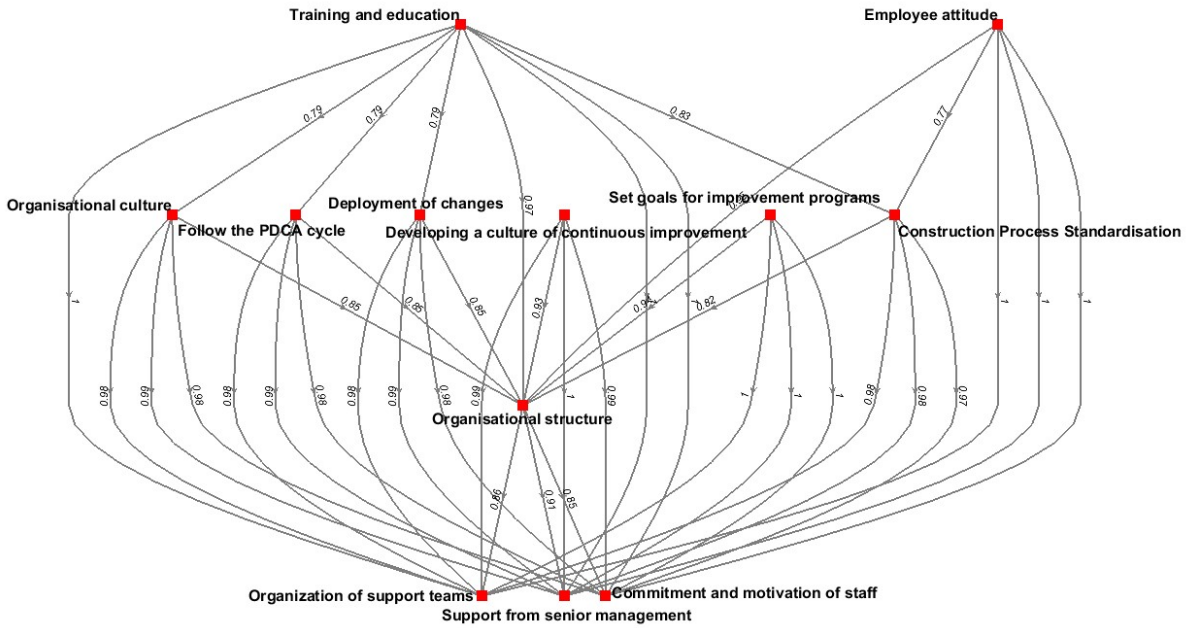

Figure 3. The modified visualised credal ranking (source: created by the authors)

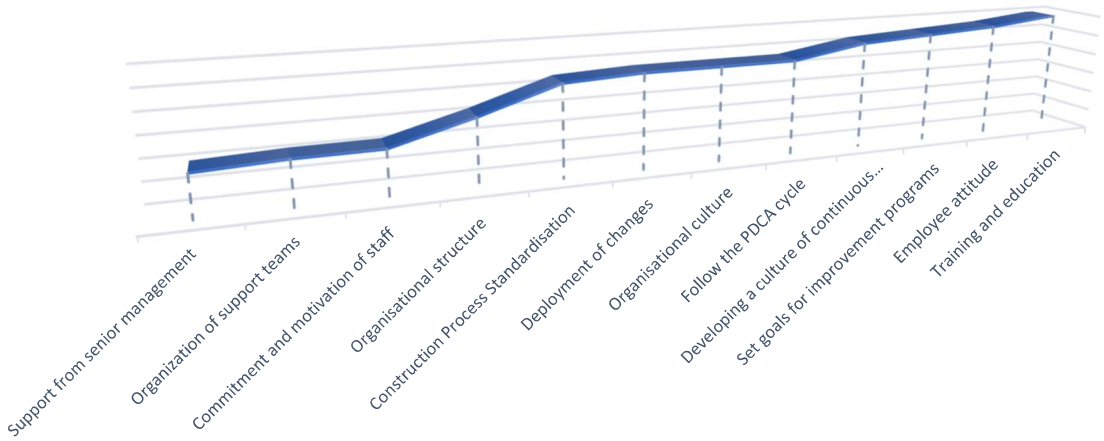

Figure 4. The ranking of the Critical Success factors of implementing Kaizen projects (source: created by the authors)

Table 1. An Overview of relevant research (source: created by the authors)

Researcher(s)	Year	Research aim	Research method		Research outcome (e.g., identified and extracted factors, etc.)
			Qualitative	Quantitative	
García et al.	2013	Kaizen implementation problems in Mexico		Rational validation, judge validation, and statistical validation	The main problems included the Education and Training of the operators, communication process, documentation and evaluation of project outcomes, human resources integration, etc.
García et al.	2014	Kaizen implementation challenges in the human resources departments		Squares algorithms	The main challenges included Management commitment and education
Suárez-Barraza and Rodríguez-González	2015	Investigate the systematic application of Kaizen in the operation management course at the University of Mexico City		Theoretical sampling	The Kaizen continuous improvement cycle (Plan-Do-Check-Action: PDCA) improved the results of operations management students
Gonzalez and Aken	2016	Examine Kaizen's critical success factors	Systematic literature review		53 Kaizen's critical success factors were identified and analysed
Dasig Jr	2017	Innovation in business processes using Define, Measure, Analyse, Improve, and Control	Case study		Kaizen project has a positive effect on the performance of organisations
Jaca et al.	2018	Develop a methodology based on environmental comfort to help companies and employees to implement Kaizen projects	Case study		The proposed methodology enables employees to identify and solve their problems
Gonzalez-Aleu et al.	2018	Identify critical success factors in hospitals.	Case study		Identifying 53 critical success factors to achieve continuous improvement in hospitals
Al-Hyari et al.	2019	Explore the results of implementing the Kaizen approach	Case study		The Kaizen approach is economical and time-saving, and its implementation helps to deal with all kinds of inefficiencies in the caravan repair project
Janjić et al.	2020	Identify the critical success factors of Kaizen implementation and their benefits in developing economies and organisations in transition	Literature review		Five success factors of Kaizen implementation were identified, and two benefits were explained
Moi and Sing	2021	Provided an operational framework consisting of Kaizen, Kaikaku, and 5S	Case study		Operational performance improvements achieved based on the recommended framework
Flug, Stellmaker, Sharpe, et al.	2022	Reduced delays in emergency tests by Kaizen	Case study	Statistical analysis	Inpatient turnaround time decreased by 54%, emergency department turnaround time decreased by 29%, and outpatient turnaround time decreased by 45%
Flug, Stellmaker, Tollefson, et al.	2022	Empowered frontline staff in Radiology with the Kaizen process	Case study	Statistical analysis	Kaizen successfully increased on-time starts, decreased lead time, increased patient and staff satisfaction, and ensured sustainability
Siew Mui et al.	2022	Examined the effect of Kaizen culture on innovation and operational performance of electrical and electronic manufacturing companies in Malaysia		Structural equation modelling (SEM)	Kaizen culture is crucial for organisations to optimise their operational performance and can be nurtured through the implementation of process innovation and organisational innovation
Ishijima et al.	2022	Improved hospital waste management using the 5S-KAIZEN-TQM framework	Case study		Hospitals that implemented the Kaizen process reduced occurrences of improper waste segregation

Researcher(s)	Year	Research aim	Research method		Research outcome (e.g., identified and extracted factors, etc.)
			Qualitative	Quantitative	
Sullivan et al.	2022	Reduced the 'non-value-added' time during appointments using a three-phase Kaizen event approach		Gemba walks	Using three-phase 'Kaizen' improved the efficiency of the clinic
Alosani and Al-Dhaafri	2022	Explored and examined the relationship between Kaizen and police performance.	Case study	Statistical analysis	Kaizen is positively associated with police performance
Jones et al.	2022	Developed process improvement routines in a higher education context with Kaizen events		Mediated Discourse Analysis	Kaizen events allow process improvement to align itself with project improvement teams
Berhe	2022	Studied Kaizen philosophy practice effect on Ethiopian manufacturing industries	Literature review	SWOT analysis	The practice of Kaizen brings monetary, nonmonetary, and qualitative results
Kharub et al.	2023	Identified the factors contributing to the practical completion of Kaizen events		EFA, CFA and partial least squares (PLS)	The performance of the work-study man and supervisors' conduct is related to the success of Kaizen events.
Androniceanu et al.	2023	Investigated the effects of using Kaizen on the energy consumption of the manufacturing sector	Case study	Statistical analysis	An energy efficiency increase in consumption was reduced by up to 7.5% in the production line, 3.5% in the extruder stage, and up to 20% for the injection stage of the manufacturing process

DMAIC: Define, Measure, Analyse, Improve, and Control

Table 2. Key Success Factors in Kaizen Projects (source: created by the authors)

ID	Success Factors	Descriptor	Reference(s)
SF_1	Organisational structure	This factor is considered a structure that empowers employees and increases the experience of employees. The organisational structure should align with continuous improvement policies, provide excellent working conditions for employees and benefit from software infrastructure	Androniceanu et al. (2023), Siew Mui et al. (2022), Janjić et al. (2020), Gonzalez-Aleu et al. (2018), Omotayo et al. (2018), Gonzalez and Aken (2016)
SF_2	Organisational culture	Organisational beliefs must be aligned with the activities and goals of continuous improvement. Organisational culture should include the value of roles, responsibilities and continuous improvement goals	Kharub et al. (2023). Androniceanu et al. (2023), Gastelum-Acosta et al. (2022), Alosani and Al-Dhaafri (2022), Siew Mui et al. (2022), Janjić et al. (2020), Omotayo et al. (2018), Gonzalez-Aleu et al. (2018), Mendez and Vila-Alonso (2018), Gonzalez and Aken (2016)
SF_3	Leadership	Leadership is responsible for the implementation of continuous improvement changes and the coordination of senior managers. Leadership should guide organisations towards Kaizen policies and ensure that Kaizen policies are implemented in the processes and monitor them	Androniceanu et al. (2023), Kharub et al. (2023), Flug, Stellmaker, Sharpe, et al. (2022), Dang-Pham et al. (2022), Gastelum-Acosta et al. (2022), Berhe (2022), Flug, Stellmaker, Tollefson, et al. (2022), Janjić et al. (2020), Al-Hyari et al. (2019), Mendez and Vila-Alonso (2018), Gonzalez-Aleu et al. (2018), García et al. (2014) and García et al. (2013)
SF_4	Relationship management	Communication between managers should be routine to improve information and communication management and maintain policies and organisational culture. Access to resources, and alignment of organisation goals with Kaizen policies during Kaizen activities and processes, depends on relationships between managers	Omotayo et al. (2018)
SF_5	Construction process standardisation	Updating information while doing Kaizen projects, deep knowledge of Kaizen processes, standard production processes, and complexity of Kaizen projects are descriptors in this factor	Flug, Stellmaker, Tollefson, et al. (2022), Flug, Stellmaker, Sharpe, et al. (2022), Moi and Sing (2021), Omotayo et al. (2018), García et al. (2014), García et al. (2013)
SF_6	Management understanding of continuous improvement	Management should understand continuous improvement goals before starting the project and plan and coordinate Kaizen projects based on continuous improvement policies	Gonzalez-Aleu et al. (2018), Gonzalez and Aken (2016)
SF_7	Support from senior management	Per Kaizen policies, senior managers who support continuous improvement goals and activities during project initiation should be supported	Alosani and Al-Dhaafri (2022), Dang-Pham et al. (2022), Mwenda and Gasper (2022), Berhe (2022), Gastelum-Acosta et al. (2022), Siew Mui et al. (2022), Moi and Sing, (2021), Janjić et al. (2020), Al-Hyari et al. (2019), Gonzalez-Aleu et al. (2018), García et al. (2014) and García et al. (2013)
SF_8	Developing a culture of continuous improvement	By developing a culture of continuous improvement, organisational processes and activities are affected, and effectiveness and efficiency are continuously enhanced. Nonetheless, to implement this factor, all levels of organisation, managers, and employees must cooperate in the same direction of Kaizen policies	Kharub et al. (2023). Ohtaka et al. (2022), Berhe (2022), Gastelum-Acosta et al. (2022), Siew Mui et al. (2022), Janjić et al. (2020), Al-Hyari et al. (2019), Gonzalez-Aleu et al. (2018), Omotayo et al. (2018), Gonzalez and Aken (2016), García et al. (2014) and García et al. (2013)

ID	Success Factors	Descriptor	Reference(s)
SF_9	Contract documentation and procurement	Includes the methods adopted in procurement, exceptional contract cases, and the accuracy of estimating financial resources in documents	Omotayo et al. (2018)
SF_{10}	Allocated resources	Allocation of financial, human, physical and time resources is necessary to implement Kaizen projects. By allocating resources, precise evaluations of Kaizen projects can be available, and it also helps to identify obstacles during planning	Andronicean et al. (2023), Alosani and Al-Dhaafri (2022), Flug, Stellmaker, Tollefson, et al. (2022), Flug, Stellmaker, Sharpe, et al. (2022), Janjić et al., (2020), Omotayo et al. (2018), Gonzalez-Aleu et al. (2018), Gonzalez and Aken (2016), García et al. (2014) and García et al. (2013)
SF_{11}	Set goals for improvement programs	Setting goals for improvement programs stabilises continuous improvement conditions and positively impacts processes, support teams, and Kaizen project activities	Andronicean et al. (2023), Dang-Pham et al. (2022), Gastelum-Acosta et al. (2022), Berhe (2022), Al-Hyari et al. (2019), García et al. (2014) and García et al. (2013)
SF_{12}	Commitment and motivation of staff	Staff commitment and motivation can prevent most of the delays and helps to create proper communication channels for the necessary coordination. The understanding of Kaizens goals and their employee benefits is realised through this factor	Andronicean et al. (2023), Flug, Stellmaker, Sharpe, et al. (2022), Berhe (2022), Janjić et al. (2020), Al-Hyari et al. (2019), Mendez and Vila-Alonso (2018), García et al. 2014) and García et al. (2013)
SF_{13}	The organisation of support teams	Organisational leadership and senior managers should organise the support teams according to the project objectives, participate in the project progress meetings, and supervise their activities	García et al. (2014) and García et al. (2013)
SF_{14}	Using an appropriate methodology	Appropriateness of problem-solving methods and their improvement is crucial to analysing methods and finding solutions in Kaizen projects	Gonzalez-Aleu et al. (2018), Gonzalez and Aken (2016), García et al. (2014), García et al. (2013)
SF_{15}	Presence of a facilitator to support the program	The facilitator must ensure Kaizen projects progress towards continuous improvement policies and provide continuous reports on project plans and activities	García et al. (2014) and García et al. (2013)
SF_{16}	Interdepartmental communication	This factor checks information between processes and activities and aligns them with the goals and policies of the Kaizen project	García et al. (2014) and García et al. (2013)
SF_{17}	Employee attitude	The positive attitude of employees towards Kaizen activities increases their interest in implementing Kaizen processes. They consider themselves a part of continuous improvement activities and supports them to perform better	Gastelum-Acosta et al. (2022), Gonzalez-Aleu et al. (2018) and García et al. (2013)
SF_{18}	Differences between the focus on improvement and the existing culture	The existing culture should move towards continuous improvement so that an organisation is affected by changes and improves its performance and processes	García et al. (2014) and García et al. (2013)
SF_{19}	Training and Education	These factors change the attitude of employees towards Kaizen policies and create a significant relationship between employees and processes, thus, improving operational performance	Berhe (2022), Gastelum-Acosta et al. (2022), Moi and Sing (2021), Mwenda and Gasper (2022), Janjić et al. (2020), García et al. (2014) and García et al. (2013)
SF_{20}	Follow the PDCA cycle	Following the PDCA cycle improves processes in Kaizen projects, and effective changes and developments occur in all processes	Kharub et al. (2023), Mwenda and Gasper (2022), Jones et al. (2022)(Berhe, 2022), Berhe (2022), Al-Hyari et al. (2019),

ID	Success Factors	Descriptor	Reference(s)
			Gonzalez-Aleu et al. (2018), Gonzalez and Aken (2016) and García et al. (2013)
SF_{21}	Software	Access to up-to-date software, such as statistical analysis, project management, process mapping, etc., is necessary to support Kaizen projects	Al-Hyari et al. (2019). Omotayo et al. (2018), Gonzalez-Aleu et al. (2018) and Gonzalez and Aken (2016)
SF_{22}	Deployment of changes	Change development must be implemented through interaction with employees. Communication, a clear and focused vision statement, is critical in this process	Alosani and Al-Dhaafri (2022), Jones et al. (2022), Flug, Stellmaker, Tollefson, et al. (2022), Flug, Stellmaker, Sharpe, et al. (2022), Gastelum-Acosta et al. (2022), Mendez and Vila-Alonso (2018), Omotayo et al. (2018), Gonzalez-Aleu et al. (2018), Gonzalez and Aken (2016) and García et al. (2013)

Table 3. Experts profile (source: created by the authors)

Panel	Expert ID	Gender		Age	Education				Experience	Area	
		F	M		PhD	MBA	MA	BA		A	I
	E_1		*	45-54				*	20^+		*
	E_2		*	35-44	*				10^+	*	
P_1	E_3		*	25-34		*			5^+		*
	E_4	*		25-34			*		5^+		*
	E_5		*	55-64				*	20^+		*
	E_6		*	45-54	*				20_+	*	
	E_7		*	25-34				*	5_+		*
P_2	E_8	*		35-44	*				10_+	*	
	E_9		*	35-44	*				10^+		*
	E_{10}	*		55-64	*				15^+	*	
	E_{11}		*	35-44			*		15^+		*
	E_{12}	*		45-54		*			15^+		*
P_3	E_{13}		*	55-64	*				20^+	*	
	E_{14}		*	55-64	*				20^+	*	
	E_{15}	*		25-34		*			5^+		*

(F) Female, (M) Male, (MA) MA/MSc/MEng etc., (BA) BA/BSc/BEng etc., (A) Academic, (I) Industry

Table 4. Linguistic terms and TFNs for fuzzy Delphi (source: Amoozad Mahdiraji et al. (2023))

Linguistic term	Triangular fuzzy numbers (a,m,b)		
	A	M	B
Very important	0.9	1	1
Important	0.7	0.9	0.9
Nearly important	0.5	0.7	0.7
Moderate	0.3	0.5	0.5
Nearly unimportant	0.1	0.3	0.3
Unimportant	0	0.1	0.1
Extremely unimportant	0	0	0

Table 5. Fuzzy Delphi method results using multiple rounds (source: created by the authors)

Success Factors	Aggregated fuzzy value of first round			Defuzzified value of first round	Aggregated fuzzy value of second round			Defuzzified value of second round	The difference between the two rounds	Average of two rounds
	a	m	b		a	m	b			
SF_1	0.5	0.63	1	0.71	0.7	0.729	0.9	0.776	0.07	0.743
SF_2	0.5	0.7	1	0.733	0.7	0.729	0.9	0.776	0.04	0.755
SF_3	0.3	0.315	0.9	0.505	0.3	0.225	0.9	0.475	0.03	0.49
SF_4	0.3	0.125	0.5	0.308	0.1	0.075	0.5	0.225	0.08	0.267
SF_5	0.5	0.63	1	0.71	0.7	0.729	0.9	0.776	0.07	0.743
SF_6	0.3	0.35	1	0.55	0.3	0.45	1	0.583	0.03	0.567
SF_7	0.7	0.81	1	0.837	0.7	0.81	1	0.837	0	0.837
SF_8	0.7	0.9	1	0.867	0.7	0.81	1	0.837	0.03	0.852
SF_9	0.1	0.105	0.7	0.302	0.1	0.075	0.5	0.225	0.08	0.263
SF_{10}	0.3	0.245	0.7	0.415	0.3	0.175	0.7	0.392	0.02	0.403
SF_{11}	0.7	0.9	1	0.867	0.7	0.81	1	0.837	0.03	0.852
SF_{12}	0.7	0.81	1	0.837	0.7	0.9	1	0.867	0.03	0.852
SF_{13}	0.7	0.81	1	0.837	0.7	0.9	1	0.867	0.03	0.852
SF_{14}	0.3	0.175	0.7	0.392	0.3	0.245	0.7	0.415	0.02	0.403
SF_{15}	0	0.015	0.5	0.172	0	0.009	0.3	0.103	0.07	0.137
SF_{16}	0.3	0.315	0.9	0.505	0.3	0.245	0.7	0.415	0.1	0.460
SF_{17}	0.7	0.9	1	0.867	0.7	0.81	1	0.837	0.03	0.852
SF_{18}	0.1	0.045	0.5	0.215	0	0.015	0.5	0.172	0.04	0.193
SF_{19}	0.7	0.9	1	0.867	0.9	1	1	0.967	0.1	0.917
SF_{20}	0.7	0.81	1	0.837	0.7	0.729	0.9	0.776	0.06	0.807
SF_{21}	0.1	0.063	0.7	0.288	0.1	0.075	0.5	0.225	0.06	0.256
SF_{22}	0.5	0.63	1	0.71	0.7	0.729	0.9	0.776	0.07	0.743

Table 6. Final success factors of Kaizen projects (source: created by the authors)

Success Factors ID	Success Factors	Defuzzified value
SF_1	Organisational structure	0.743
SF_2	Organisational culture	0.755
SF_3	Construction Process Standardisation	0.743
SF_4	Support from senior management	0.837
SF_5	Developing a culture of continuous improvement	0.852
SF_6	Set goals for improvement programs	0.852
SF_7	Commitment and motivation of staff	0.852
SF_8	The organisation of support teams	0.852
SF_9	Employee attitude	0.852
SF_{10}	Training and Education	0.917
SF_{11}	Follow the PDCA cycle	0.807
SF_{12}	Deployment of changes	0.743

Table 7. Pairwise comparison input (source: created by the authors)

Best vs Other Success Factors				Worst vs Other Success Factors			
Panel	**P_1**	**P_2**	**P_3**	**Panel**	**P_1**	**P_2**	**P_3**
Best Success Factors	**Organisational culture**	**Training and Education**	**Employee attitude**	**Worst Success Factors**	**Organisational structure**	**The organisation of support teams**	**Support from senior management**
SF_1	7	2	5	SF_1	1	8	5
SF_2	1	7	2	SF_2	7	6	5
SF_3	5	3	3	SF_3	6	8	4
SF_4	6	8	6	SF_4	3	2	1
SF_5	2	2	2	SF_5	6	7	4
SF_6	2	3	2	SF_6	6	8	5
SF_7	6	7	5	SF_7	2	3	2
SF_8	5	9	4	SF_8	3	1	2
SF_9	2	3	1	SF_9	5	8	6
SF_{10}	2	1	2	SF_{10}	6	9	5
SF_{11}	3	2	3	SF_{11}	5	7	4
SF_{12}	2	4	3	SF_{12}	5	8	4

Table 8. The final weights of success factors of implementing Kaizen projects (source: created by the authors)

Success Factors	ID	Weight	Rank
Organisational structure	SF_1	0.0643	9
Organisational culture	SF_2	0.0922	6
Construction Process Standardisation	SF_3	0.0883	8
Support from senior management	SF_4	0.0396	12
Developing a culture of continuous improvement	SF_5	0.1044	4
Set goals for improvement programs	SF_6	0.1083	3
Commitment and motivation of staff	SF_7	0.0437	10
The organisation of support teams	SF_8	0.0430	11
Employee attitude	SF_9	0.1122	2
Training and Education	SF_{10}	0.1195	1
Follow the PDCA cycle	SF_{11}	0.0924	5
Deployment of changes	SF_{12}	0.0920	7

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Table 9. Readiness levels of Kaizen projects in organisations (source: created by the authors)

Readiness Level	Score	The situation of the studied organisation
KPR_1	$0 < X < 20$	The primary aims of Kaizen, including training and education and employee attitude, have not been paid attention. The organisation should prioritise these two factors in its future planning.
KPR_2	$20 \leq X < 40$	The concept of Kaizen and organisational goals have been described. However, the organisation is not in the operational phase and must consider more success factors.
KPR_3	$40 \leq X < 60$	The organisation has an appropriate position towards the primary goals of the Kaizen, training, education, and employee attitude. However, other factors are neglected, and the organisation should study and plan toward succeeding in the highly important factors.
KPR_4	$60 \leq X < 80$	The organisation has entered the operational phase of implementing Kaizen projects. These organisations are facing continuous improvement in their organisational productivity.
KPR_5	$80 \leq X \leq 100$	The organisation is fully prepared to implement Kaizen projects regarding hardware, software, etc. These organisations should adopt a continuous improvement policy on all critical factors.