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Perceived Factors Affecting the Implementation of Occupational Health and Safety Management Systems in the South African Construction Industry

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Abstract: Although notable efforts have been made in the past to improve Occupational Health and Safety (OHS), the overall performance has not significantly improved as high-level injuries, risks, and fatalities continue to occur. Earlier studies have shown that implementing an Occupational Health and Safety Management System (OHSMS) ensures a reduction in accidents on site, which is, however, not easy due to the many challenges arising during its implementation. The research objectives were to identify, in order of importance, factors that affect the implementation of an OHSMS on construction sites and to analyse how an OHSMS can be implemented in the construction industry of the Western Cape, South Africa, using the Plan Do Check Act (PDCA) method. The research questionnaire obtained online opinions from construction professionals. The data were analysed using the Statistical Package for Social Sciences (SPSS) software version 27.0. The data were interpreted through Cronbach's alpha coefficient, frequencies, descriptive statistics, and a multi-regression analysis. A multi-regression test was conducted to determine the relationship between internal and external factors and the implementation of an OHSMS, including the use of the PDCA method. The findings reveal that both internal and external factors affected the implementation of the OHSMS. The most important internal factors were risk control strategies, senior management commitment, and support and communication channels. The most common external factors were pressure from clients on project delivery, company reputation, OHS enforcement, and government legislation. A framework was developed to outline how an OHSMS can be implemented using the PDCA approach based on the findings from this study. The framework can be adopted by the construction industry to improve effectiveness when implementing their OHSMS.

Keywords: health and safety management systems; construction sites; risk management; Plan Do Check Act (PCDA); construction hazards

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1. Introduction

1.1. Background of Studies

The International Labour Organisation (ILO) [1] estimates that more than 2.78 million people die annually because of occupational accidents or work-related ailments. Although noteworthy efforts have been made in the past within the construction industry to improve Occupational Health and Safety (OHS), the overall performance has not significantly improved, and high-level injuries and fatalities continue to occur [2]. Studies conducted have also shown that construction workplaces are potential risk areas where accidents and injuries are subsequently prone to occur [3–5]. In recent years, the rapid growth of the construction industry in developing and underdeveloped countries has contributed to an increase in occupational accidents and fatalities [6]. Considering the context of the construction industry, the 2018 report from the Department of Labour in South Africa reported that the compliance rate with OHS regulations was below 50% and most construction companies still did not have an OHSMS in place [7]. An OHSMS is defined as a set of institutionalised correlating and relating tactical elements designed to achieve occupational OHS objectives [8]. The OHSMS has also been recognised, not only as a moral reference but as a method to improve the transparency, productivity, and competitiveness of an organisation [9]. The objective of the OHSMS, according to ISO 45001 [1], is to motivate employees to constantly improve OHS performance. It is becoming increasingly common for organisations to consider the implementation of an OHSMS as a tool for promoting their sustainability because it provides a systematic framework for managing OHS risks and opportunities [10]. The ISO 45001 standard specifies requirements for an OHSMS, along with guidelines for its use, so that an organisation can proactively improve its OHS performance in preventing injuries and accidents [11]. The implementation of an OHSMS, as per the ISO 45001 guidelines, enables companies to reduce workplace injuries and incidents [12]. Previous studies have shown that where an OHSMS was properly implemented, it resulted in improved working conditions and reduced accidents for organisations [13]. It also enables organisations to be aware of risks and be compliant with regulations [7]. Non-compliance with OHS regulations can result in accidents on site, penalties and fines, and compromise an organisation's credibility [7]. The Construction Industry Development Board (CIDB) report notes that South Africa continues to have a low level of compliance with OHS legislation, specifically in the construction sector [5]. Organisations must implement an OHSMS to address risks and changes that may occur on site [14]. However, the implementation of an OHSMS is riddled with problems due to many factors [12]. There are both external and internal factors that affect the implementation of OHSMSs in the construction industry worldwide [15,16]. It is possible that these factors, if not accounted for, lead to a poor OHSMS, which results in further on-site injuries, accidents, and fatalities [11].

1.2. Internal and External Factors Affecting the Implementation of OHSMSs

Previous studies identified global internal factors, such as management commitment, OHS policies, OHS cost allocation, company size, OHS training, employee involvement, OHS culture, OHS communication, OHS regulations and procedures, system integration and uncertainty in reporting systems, identification and risk reduction processes, and the development and implementation of risk control strategies that affect OHSMS implementation [17,18]. These factors were broad and generalised; previous studies, however, did not indicate if these factors could apply to the construction industry [17]. Similarly, exploratory research found that there were interlinking factors, namely organisational, managerial, legislative, social, environmental, and personnel, that further affected the implementation of OHSMSs [19].

Further internal factors that affected the implementation of OHSMSs were identified as a lack of understanding of the importance of integrated management and problems with the integration of different standards [13]. The difficulty in defining the appropriate management indicators in OHS and the complexity of changing company policy and culture affect the implementation process. When operating integrated management systems, most organisations face difficulties, such as the complexity of internal management and the subsequent reduction in efficiency in management, which may incite discord with the organisational culture and even hostility among the employees, which increases management costs [13]. The high costs associated with the implementation and management of OHSMSs are a major barrier to their implementation [7]. Previous studies have failed to explain the key individuals directly involved in OHSMS implementation and management and how data can be incorporated and communicated to assess and manage existing risks [13].

An Iranian study found that external factors such as OHS regulation enforcement, OHS authorities' support, auditing, and external incentives were deemed to affect OHSMSs [20]. Enforcing compliance towards OHS is undeniably an important factor in achieving optimum workplace safety, but unfortunately, the levels of compliance are generally low [21]. As it has been established that construction sites are high-risk areas, the main goal of

OHSMSs is to prevent accidents resulting in injuries, disabling conditions, and fatalities in the workplace, as well as to prevent workplace illnesses and minimise risk [14]. Notably, if these factors are not taken into consideration during OHSMS implementation, safety performance will be undoubtedly affected within an organisation [22].

1.3. Integrating Risk Management into OHSMSs

The nature of construction projects makes risk management a crucial process, and all steps in this process need to be considered during the implementation stage [14]. Arguably, risk management is a roadmap to the successful implementation of a risk management process. Risk management must be carefully realigned when developing an OHSMS to improve OHS. Any failures in the process of assessing the risks of OHS add to the challenges of implementing an OHSMS [13,19]. Studies have shown that construction accidents are mostly attributed to workers' mistakes and flaws in the risk management plan [23]. Most incidents or accidents occur because of a lack of recognition towards the hazards and risks related to work or activities in the workplace [23]. Managing risks in the construction industry is necessary to methodically assess general risk management factors for safeguarding different project participants [22]. To analyse the OHS risks associated with any project properly, all potential hazards must be taken into consideration [24].

Risk management can be considered an integral part of OHS within an organisation and can be applied to develop and implement the OHSMS policy and manage the associated risks [25]. Effective risk management increases the productivity and competitiveness of enterprises while contributing to the sustainability of social protection systems by reducing the cost of accidents and occupational diseases. Risk management can be defined as an endless process throughout the project life cycle [26]. However, to take advantage of its full potential, risk management should be implemented at the earliest stage, the feasibility design, and the construction stage. It can be argued that there are various risk management models and processes within the construction industry for managing project risk. Risk management is an iterative process, where each aspect should be planned and observed in each phase of the project [27].

The process of risk management includes four steps: risk identification, risk analysis or assessment, risk management, and risk control [28]. To implement an OHSMS in an organisation, occupational hazards must first be identified [29]. Risk identification is the process of identifying possible risks to the project and documenting their characteristics [29]. There are several methods and techniques that can be used to identify risk [30]. Risk planning entails developing how to organise and identify risks, performing qualitative and quantitative analyses, planning responses to risks, monitoring risks, and controlling risks throughout the project lifecycle [31]. Accordingly, the response strategy and method chosen depend on the type of risks involved and the risk response tactics [30]. After the risks are identified, they are analysed to identify their qualitative and quantitative effects on a project to ensure that suitable steps can be taken to lessen the effects [27]. As a further means of ensuring continuous improvements in the OHSMS, risk assessments are also useful for assessing and achieving the intended outcomes of system deployment [32]. A risk assessment comprises both quantitative and qualitative risk assessments [33]. To be efficient, effective, and simple, it can be argued that risk management should be integrated into management practices and systems that are already familiar to construction organisations [34]. An integrated risk management plan refers to an integrated collection of activities that take place in an organisation to detect, assess, evaluate, and adjust the likelihood of the occurrence of certain events affecting one or more entities, as well as the effect of those events [5]. Arguably, the core principles of risk management are the same, but they differ depending on the industry and organisation.

1.4. Using PDCA to Implement OHSMSs

Many approaches can be used to integrate a management system, such as the standard approach, the systems approach, the Total Quality Approach (TQA), and the Plan Do Check

Act (PDCA) approach [35]. The choice of integration approach is dependent on the size, types of industry, the culture of the organisation, and the availability of resources [36]. As there is no specific standard system for implementing OHSMSs, the decision on the choice of system is dependent on the type of organisational needs [36]. Companies must select an appropriate method to integrate their management systems based on factors such as size, industry, business culture, and the resources available [35]. The system frequently used to continually monitor and implement OHSMSs in the construction industry is the PDCA model [36]. The PDCA model applies to all types of organisations and all groups and levels, as it provides a framework for applying enhancement techniques and allows project plans to adjust as learning happens [37]. The PDCA cycle is a continuous process improvement model that teaches organisations to plan an action, move towards it, check its conformity with the plan, and act on the lessons learned [38].

The PDCA cycle consists of four phases, which are Plan, Do, Check, and Act. The planning (P) stage involves recognising an opportunity and planning a change by creating an OHS policy, allocating resources, providing skills, developing the organisation of the system, and identifying hazards and risks [37]. At this stage, the risk management plan is formulated as well. The doing (D) phase refers to the actual implementation of the OHSMS stage and also involves a risk identification assessment and the hierarchy of risk controls as the first two effective components in an organisation's OHSMS [39]. The check (C) stage involves reviewing the test, analysing the results, and identifying 'learn-things' [38]. The act (A) phase is the final step to close the cycle with an evaluation of the system through continual improvement and the preparation of the system for the next cycle [37]. The PDCA cycle, when applied, reduces waste on waiting time, idleness, failure, and defects [40]. The PDCA method can be linked to risk management and OHSMSs [32]. When applied to OHS, the PDCA model translates into five key elements of successful OHSMSs, which are planning, organising, implementing, measuring, and reviewing performance [39].

1.5. Outline and Gaps of Study

The literature reviewed indicates that the factors affecting the implementation of OHSMSs within the construction industry in South Africa have not been adequately studied, as most studies conducted were theoretical and from developed countries. Since developed countries are fully equipped to deal with OHSMSs, the current study aimed to investigate if these factors would be applicable to a developing country like South Africa.

Furthermore, the current study presents a uniqueness, as the factors in previous studies were too generalised as they did not specify the type of industry. The current study aimed to show which factors were applicable to the construction industry, as these would differ greatly from those of mining or agriculture. This study focused on identifying, in order of importance, the factors that affect the implementation of OHSMSs in the construction industries of South Africa. Finally, the study was able to formulate a framework for implementing OHSMSs using the PDCA method by integrating the risk management plan. The framework can be used by construction professionals responsible for the implementation of OHSMSs. The identification and assessment of these factors are imperative, as they ensure an effective OHSMS.

2. Research Methodology

2.1. Type of Research Method Used

In this study, quantitative research was adopted, using questionnaires containing both open- and closed-ended structured questions that were used to obtain the data.

The structured questionnaire was created following the study's objectives, and the questions were formulated through gaps identified in the reviewed literature.

Data were collected from construction-related professionals to gain insight into the implementation of OHSMSs and the use of the PDCA model when implementing an OHSMS. The method was chosen because it allowed the validity of the study to be strengthened by compensating for the shortcomings of the other method and eliminating the possibility of personal bias [41].

2.2. Population and Sampling Method

The study used the probability sampling technique as there was an assumption that there are both internal and external factors that affect OHSMS implementation. In this study, the stratified random sampling method was used. Stratified random samples minimise the potential for human influence in choosing cases for inclusion in the study and provide one with a sample that is well represented in the population being examined [42]. The respondents consisted of people in supervisory positions, both male and female, who possessed adequate experience or qualifications in the construction industry. As most of the literature indicated that the research objectives were carried out in different trades and sectors, such as mining, agriculture, etc., the current research considered the construction industry as a stratum that could be used to compare data from other industries as provided in journals where similar research was conducted.

Section A comprises biographical details of the participants.

Since the construction industry is vast, participants who implement an OHSMS and manage it daily were selected. The sample size consisted of participants holding construction supervisory positions, consisting of project managers, contract managers, site foremen, site agents, health and safety officers, and site agents. Figure 1 indicates the type of organisation represented. The 16% others constitute respondents from other organisations, such as municipal organisations.

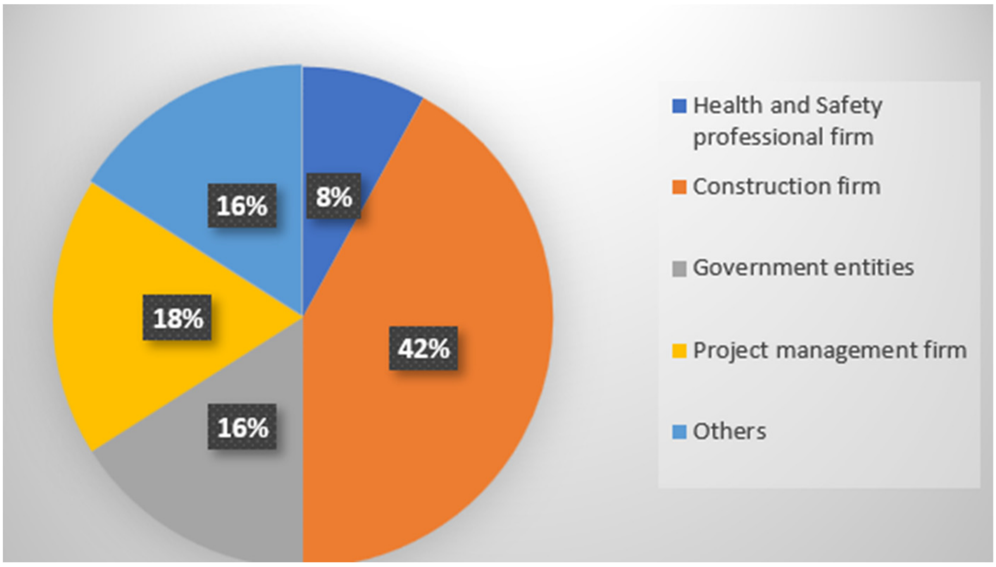

Figure 1. Type of organisation.

The data in Table 1 show the professional representation of the respondents. Notably, most of the respondents were project managers (26%), as they are the ones responsible for implementing OHSMSs on sites, whilst the lowest representation was the professional health and safety agents, as they usually only check on compliance issues.

Table 1. Respondents' professions.

Respondents' Professions	Frequency	Percentage
Project Manager/Operations Manager	13	26%
Quantity Surveyor/Engineering Surveyor	11	22%
Other positions	11	22%

Table 1. *Cont.*

Respondents' Professions	Frequency	Percentage
Health and Safety Manager	3	6%
Health and Safety Officer	3	6%
Site Manager	2	4%
Architect	2	4%
Site Foreman	2	4%
Professional Health and Safety Agent	2	4%
Contracts Manager	1	2%
Total	50	100%

2.3. Reliability of Data

To ensure the reliability of the data collected, the results were assessed using the Cronbach alpha coefficient test. To determine the reliability of the respondents' information, the Cronbach Alpha (α) reliability test was used as an index to objectively measure the reliability of a questionnaire instrument based on the data collected [43]. The acceptable values of α for consistency range between 0.70 and 0.95 [43].

Table 2 shows that the Cronbach α reliability score was higher than the minimum value of 0.70; hence, the research tool used was deemed to be reliable. Cronbach's α coefficient analysis was used to test the reliability of the quantitative research questions. The reliability score was high, indicating reliable responses. It is, therefore, possible to generalise the results from this study to the South African construction industry.

Table 2. Reliability test.

Sections	Cronbach's Alpha
Internal factors	0.84
Effects of internal factors	0.79
External factors	0.79
Effects of external factors	0.79
Integration of risk management plan	0.87
PDCA method when implementing OHSMSs	0.84

2.4. Data Analysis

The quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) version 27.0 software. Frequencies, descriptive statistics, and a regression analysis were used to present and interpret the data. The mean (M) and standard deviation (SD) were used to determine the average values and variability of the data. The ranking of both internal and external factors was obtained through a Likert scale. The number of responses from distributed questionnaires (114) was 50, which is 44% and was deemed satisfactory to produce significant findings as required for computing statistical data based on a data set of similar studies conducted, such as Yiu et al. (2019) [44] who had 32 respondents from a data set of 4 organisations; Mashwama et al. (2018) [3] whose study had 42 respondents; and Ligade and Thalange (2013) [36] with data set from 1 organisation.

Section B comprises a list of internal and external factors that affect the implementation of OHSMSs in order of least to most important. These factors were identified through the literature, and the questions were formulated using the gaps of previous, similar studies.

The factors were assessed and ranked through the Likert scale. The mean and standard deviations were also analysed to determine the extent to which the respondents agreed on the factors affecting OHSMS implementation. Based on previous research, it is safe to conclude that the response rate for this study was sufficient.

Section C of the questionnaire entails how the PDCA method is used to implement an OHSMS, taking into consideration construction risks.

The first step was to formulate a risk management plan. The methods frequently used for risk identification, risk analysis, and risk assessment were tested using a closed-ended question, where respondents were asked to select the method used at their respective organisations.

A multi- and linear-regression analysis was performed to test the relationship between OHSMS implementation and the PDCA method. The independent variable was identified as OHSMS implementation, and the dependent variables were identified as internal factors, external factors, and the PDCA method. A linear regression analysis was conducted to test if there was a relationship between OHSMSs, the factors, and the PDCA method. Figures 2–4 show the linear regression, which indicates that there is a positive relationship between OHSMS implementation and these variables.

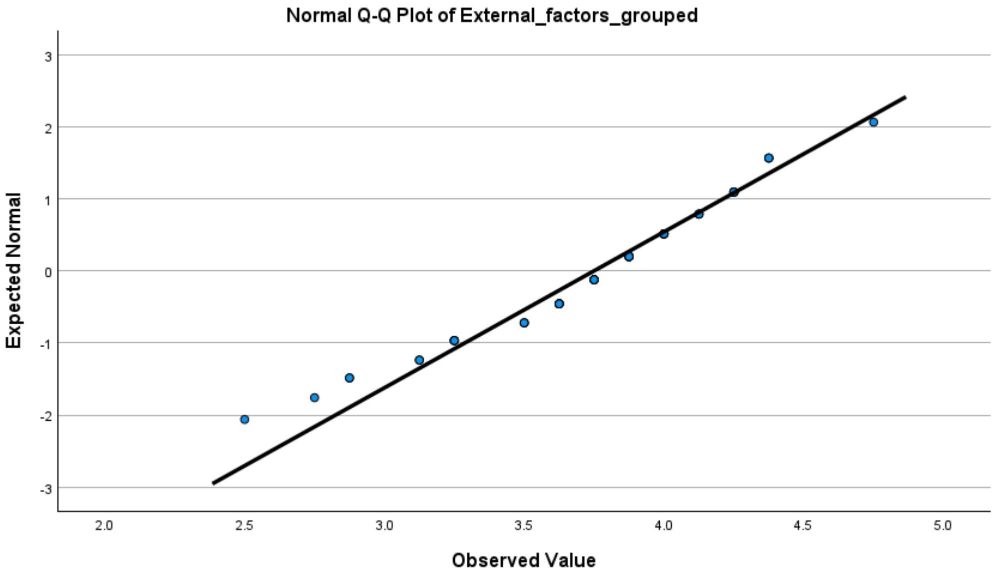

Figure 2. Linear regression of external factors.

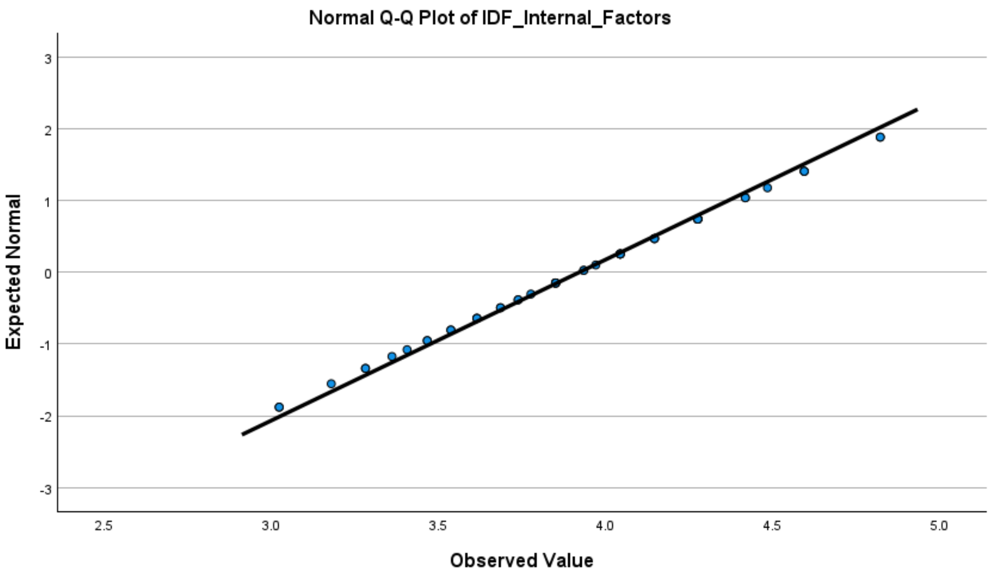

Figure 3. Linear regression of internal factors.

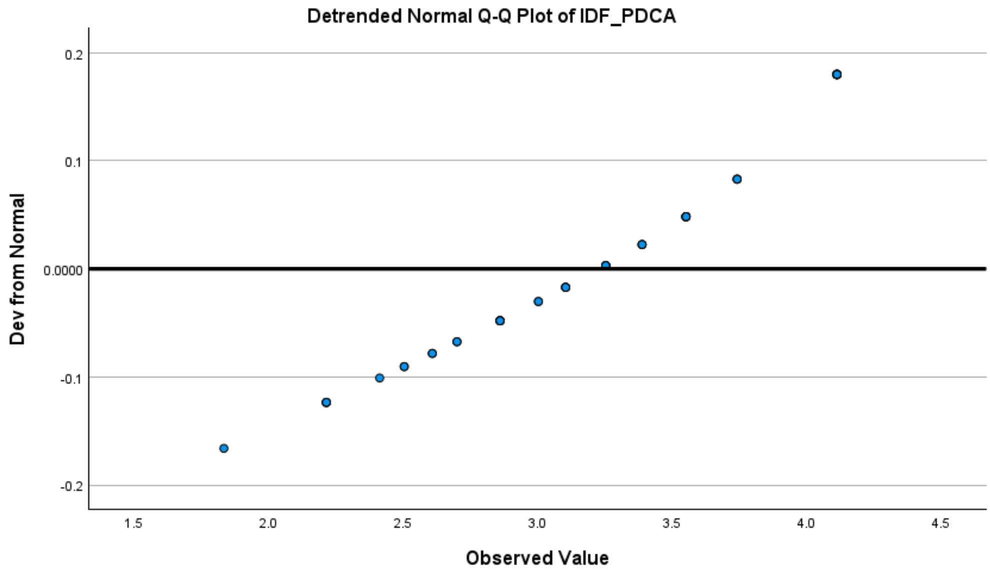

Figure 4. Linear regression of PDCA method.

3. Results

The findings of this study are from the quantitative analysis conducted.

3.1. Section B: Internal and External Factors

3.1.1. Ranking of Internal Factors Affecting the Implementation of OHSMSs

The results in Table 3 show that most of the respondents agreed that there were internal factors that affected the implementation of OHSMSs. The factors with the highest mean were considered to imply that most of the respondents agreed that the factor had an effect to a greater extent on the implementation of OHSMSs. The results also managed to rank, in order of importance, the factors that affected the implementation by adding the agree and strongly agree Likert percentages. Confirming the ranking, the results showed that the highest-ranked internal factors were as follows: risk control strategies (90%), senior management commitment and support (82%), and communication channels (88%). The least-rated factors were internal incentives (58%), which had the lowest ranking, followed by a lack of competent workers (64%) and uncertainty in reporting systems (64%).

Table 3. Ranking of internal factors.

Factors	Effect of Factor Response %						Ranking Agree + Strongly Agree	Mean	Std, Dev.
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Agree + Strongly Agree %			
	1	2	3	4	5				
Risk control strategies		2	8	60	30	90	1	4.18	0.66
Communication channels			12	62	26	88	2	4.14	0.61
Training, hazard perception, education, risk awareness	2	2	8	60	28	88	2	4.10	0.79
Safety culture	2	4	10	52	32	84	4	4.08	0.88
Senior management commitment and support		6	12	42	40	82	5	4.16	0.87
Working conditions and scope of work	2	4	12	62	20	82	5	3.94	0.82
Risk identification, management, and processes	2		18	46	34	80	7	4.10	0.84

Table 3. *Cont.*

Factors	Effect of Factor Response %					Agree + Strongly Agree %	Ranking Agree + Strongly Agree	Mean	Std, Dev.
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree				
	1	2	3	4	5				
Allocation of resources	2	6	12	44	36	80	7	4.06	0.96
OHS training	4	4	12	46	34	80	7	4.02	0.99
Safety policy	6	4	18	52	20	72	10	3.76	1.02
Cost of implementation	2	6	22	48	22	70	11	3.82	0.92
Constrictive project durations		14	16	58	12	70	11	3.68	0.87
Organisational structure		6	28	42	24	66	13	3.84	0.87
Uncertainty in reporting systems	2	10	24	46	18	64	14	3.68	0.96
Lack of competent workers	4	8	24	42	22	64	14	3.70	1.04
Internal incentives		20	22	46	12	58	16	3.50	0.95

3.1.2. Mean Ranking of External Factors Affecting the Implementation of OHSMSs

Table 4 shows the top-ranked aspects that were deemed to contribute most to the implementation of OHS externally in order of most to least importance. The external factors with the highest ranking were pressure from clients on project delivery (82%), company reputation (82%), and OHS enforcement and government legislation (80%). These results show that the respondents agreed that these had the greatest influence on the implementation of OHS compared to the rest of the external factors. Two noticeable least-rated external factors that influence the implementation of OHS on construction sites were external incentives (60%) and international trends (50%).

Table 4. External factors' ranking.

Factors	Effect of Factor Response %					Agree + Strongly Agree %	Ranking Agree + Strongly Agree	Mean	Std, Dev.
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree				
	1	2	3	4	5				
Pressure from clients on project delivery		10	8	56	26	82	1	3.98	0.87
Company reputation		4	14	64	18	82	1	3.96	0.70
OHS enforcement and government legislation	2	6	12	60	20	80	3	3.90	0.86
OHS auditing procedures		6	18	60	16	76	4	3.86	0.76
COVID regulations	2	10	12	62	14	76	4	3.76	0.89
Support from OHS authorities	2	6	22	50	20	70	6	3.80	0.90
External incentives	2	16	22	52	8	60	7	3.48	0.93
International trends	2	22	26	48	2	50	8	3.26	0.90

3.2. Section C Implementation of the OHSMS Using the PDCA Method by Analysing Construction Risks

3.2.1. Multiple Regression Analysis of the PDCA Method

When predicting the value of a variable based on the values of two or more variables, researchers often employ multiple regression [45]. The independent variables in this case were the implementation factors. The dependent variable was the PDCA model. Beta coefficients (β) were used to measure the association between the predictor variable and the outcome, i.e., the degree of change in the outcome variable for every one unit of change in the predictor variable. If β was positive, it indicated the existence of a relationship.

Table 5 shows the relationship between using the PDCA method and OHSMS implementation. The results show that:

- Planning (P) seems to have a positive influence on internal factors (β = 0.04) and external factors (β = 0.18) during the implementation of OHSMSs.
- The doing (D) phase indicated positive effects on both internal (β = 0.19) and external (β = 0.12) factors during the implementation of OHSMSs. Furthermore, an improved exploration of solutions to accidents on site was likely to result in positive contributions to both internal (β= 0.17) and external (β = 0.21) factors during the OHSMS implementation.
- The check (C) stage resulted in positive contributions to both internal (β = 0.17) and external (β = 0.03) factors during the OHSMS implementation.
- For the act stage (A), improved identification of gaps and corrective actions in the OHSMS were likely to negatively influence both internal (β = −0.64) and external (β = −0.35) OHS implementation.
- Lastly, continuous improvement in the OHSMS was likely to result in positive contributions to internal (β = 0.27) and negative influences on external (β = 0.18) factors during the OHSMS implementation.
- Overall, the results show that there is a strong relationship between the PDCA model and the implementing factors.

Table 5. Regression analysis of PDCA.

PDCA Stages		OHSMS Implementation					
		Internal Factors			External Factors		
		Coef. (β)	(95% Conf. Interval)		Coef. (β)	(95% Conf. Interval)	
P	Risk planning, identification, analysis, and risk management	0.04	−0.40	0.48	0.18	−0.22	0.58
D	Doing phase of actual implementation of the OHSMS	0.19	−0.39	0.77	0.12	−0.41	0.65
	Exploration of solutions to accidents on sites	0.17	−0.39	0.74	0.21	−0.31	0.72
C	Has the health and safety checklists and audits improved	0.17	−0.40	0.73	0.03	−0.49	0.55
A	Identification of gaps and corrective actions in the OHSMS	−0.64	−1.45	0.18	−0.35	−1.09	0.35
	Continual improvement on the OHSMS	0.27	−0.40	0.93	−0.18	−0.78	0.42

3.2.2. Formulation of the Risk Management Plan to Be Integrated into the PDCA Method

Risk Management Plan

Table 6 shows the most common methods used in organisations during the risk identification process on construction sites in descending order. A checklist was the most common method used to identify risks on construction sites, as it had the highest frequency.

During risk planning, the most common method used in organisations was risk mitigation/reduction, whereas risk exploitation had the lowest frequency. The most common method used during risk assessments was quantitative risk analysis.

Table 6. Methods used to formulate a risk management plan.

Risk Stage	Method	Freq. (%)	Ranking
Methods used to identify risk	Checklist	24	1
	Experience	22	2
	Brainstorming	19	3
	Expert judgment	19	3
	Swot analysis	13	4
	Interviews	10	5
	Delphi technique	6	6
	Others	3	7
Methods used during risk planning	Risk mitigation/reduction	22	1
	Risk avoidance	18	2
	Contingency plan	17	3
	Risk acceptance	13	4
	Risk transfer	10	5
	Risk sharing	10	5
	Risk exploitation	3	6
Methods used during risk assessment	Quantitative risk analysis through assessment of risk to determine the effect on time, cost, and duration of the project	22	1
	Risk categorisation and risk urgency assessment through identification of threats	16	2
	Probability/impact risk rating matrix through risk rating, e.g., high, medium, or low	16	2
	Qualitative risk analysis through the probability and impact of risk	14	3
	Decision Trees	12	4
	Risk probability and impact assessment through evaluation of the likelihood of the occurrence of a specific risk and the impact of the risk	10	5

4. Discussion

The use of OHSMSs has been shown to reduce work-related risks and continuously improve conditions [12]. The current study was conducted to obtain answers to the following research questions:

i What are the internal and external factors that affect the implementation of OHSMSs?
ii How the PDCA method is used to implement the OHSMS, taking into consideration construction risks.

The results showed that there were both internal and external factors affecting the implementation of the OHSMS. Furthermore, there is a relationship between these factors and the implementation of OHSMSs. This implies that these factors influence the implementation of OHSMSs, and they need to be addressed for the implementation to be successful within the South African construction industry context.

4.1. Internal Factors

The findings from Table 3 listed internal factors in descending order of importance based on the Likert scale for respondents who agreed and strongly agreed on the extent to which that factor had an effect on the implementation of OHSMSs. The mean values in the findings also showed that most of the respondents agreed that internal factors affected the implementation. To obtain an accurate assessment of OHSMS factors, each factor should be monitored and measured with appropriate criteria and indicators. Focusing on just one factor of OHSMSs can be misleading and ineffective [46]. The results also indicate that there is a very strong relationship between these factors and OHSMS implementation.

Risk control strategy

- Contrary to expectations, the risk control strategy was found to be the leading factor that would affect the implementation of OHSMSs, even though a previous study by da Silva and Amaral [13] did not list it as one of their top five factors. There are several possible explanations for this result, one of them being that their study was purely theoretical and was generalised with no reference to a particular industry. However, the current study was empirical, focusing on the construction sector in South Africa.
- Additionally, the construction risk for a developing country like South Africa would be higher as compared to a developed country due to advancements in areas such as personal protective equipment (PPE) and OHS technology. The literature reviewed has iterated that construction sites are high-risk areas where accidents are prone to occur, and organisations must take appropriate measures to control the risks. These could be controlled using methods such as risk reduction and risk avoidance, as shown in Table 5.

Communication

- Communication remains an essential success factor [44]. The communication challenges in South Africa can also be attributed to the language barriers that exist, as there are eleven official languages and some OHS terms are difficult to explain and translate into the vernacular language of an unskilled labourer. Therefore, proper communication channels must be established. Furthermore, equipment design and improved work practices that promote proper communication procedures will result in an improved safety environment [47].

Training, hazard perception, education, and risk awareness

- Although many respondents agreed that their organisations had made great positive strides toward training, hazard perception, education, and risk awareness on OHS, it was still ranked as a leading factor that affects the implementation of OHSMSs. These findings are consistent with a survey that found that the systematically inadequate behaviour, the inadequate involvement in OHS activities, and the lack of awareness of the relevance of OHS among employees made it difficult to implement OHSMSs [48].
- When implementing an OHSMS, it is crucial to reinforce risk assessment education [49].

Safety culture

- By examining the safety culture factor, an organisation's safety culture is determined by its values, attitudes, perceptions, and competencies, which determine its commitment to OHS and its style and proficiency in managing it. Workers need to understand the importance of managing OHS, different standards and attributes, and observing the company culture [13]. Previous studies found that employees create safe conditions through actions such as participation in safety training, voluntary OHS activities, and OHS-related decision making [46].
- Although the findings from the current study did not rank safety culture in its top three, previous findings showed that employees' ignorance or negative attitudes toward OHS, a lack of safety culture, and employee participation were the most important factors [10]. This may be because their study was solely based on a literature review.

Working conditions and scope of work

- Construction workplaces are potential risk areas where accidents and injuries are more likely to occur [3,4]. Although much effort has been made over the years to secure safe working conditions on site, the rapid growth of the construction sector in South Africa means that more construction risks have arisen, and most risk management plans would need to be updated to ensure safe working conditions. Construction sites are all unique and different; hence, the OHSMS needs to be constantly updated to reflect the current conditions.

Senior management commitment and support

- Regarding the importance of senior management commitment and support, the results were consistent with those of empirical studies, as factors were considered as key driver constructs when implementing OHSMSs [13,44]. Management leadership and commitment towards OHS are the base factors when implementing OHSMSs [50].
- An important issue emerging from these findings was that most employees participated in OHSMS implementation. The success of a safety management system depends on the type of leadership and employee involvement [19]. Management commitment has a positive impact on worker safety behaviour and participation in safety management [51]. Similarly, senior management support should cover safety meetings, safety training, personnel protection, on-site inspections, performance assessments, incentives, and other major safety management affairs [52].
- Management commitment is a major driving force during the implementation of the OHSMSs. Top management obligations should go above and beyond, involving expertise in OHS hazards and a responsibility to ensure that management practices stimulate safety and health at work.

Risk identification, management, and processes

- Risk identification, management, and processes are critical factors that are still prevalent on construction sites. Construction organisations in South Africa still need to continue addressing risk assessments when implementing OHSMSs. When implementing OHSMSs, it is crucial to reinforce risk assessment education [49].
- A safety management system's effectiveness requires continuous monitoring and the improvement of risks [19]. Methods such as checklists and brainstorming, among others, could be used for risk identification, as per Table 6.

Allocation of resources

- The adequate allocation of resources towards OHS plays a significant role in OHSMS implementation. Project constraints and system limitations due to the unavailability of suitable construction resources affect the implementation of OHSMSs [44]. The high costs associated with OHS further make it difficult to implement OHSMSs [18].
- Most resources are channelled towards production, and the high costs associated with OHS further make it difficult to implement an OHSMS, especially in SMEs. Then, there is also the argument over who carries the OHS-related costs.

OHS training

- OHS training is an important factor that affects OHSMS implementation. It is evident that most training interventions do not yield tangible benefits and may lead to the waste of resources [5]. Stakeholders in the construction industry must possess a good understanding of the characteristics of training interventions if they are to improve safety performance. Organisations that offer training in OHS have good positive results on their OHSMSs [49]. Senior managers and supervisors on construction sites are not mandated by the Department of Labour in South Africa to have an OHS qualification, which presents challenges when implementing OHSMSs.
- Incompetent employees can result in poor management decisions and the approval of incomplete procedures and instructions. This can be attributed to a failure to provide necessary training to employees [51].
- Safety training should be used to increase the safety awareness and knowledge of both management staff and workers [52]. Training interventions that integrate visual cues to guide hazard recognition, immersive experiences in virtual environments, pedagogical training principles, personalisation of training experiences, testing and feedback, and other elements can improve training effectiveness and outcomes [2].

Safety policy

- The results showed safety policy to be the second most influential factor when implementing the OHSMS. This aligned with other results [50]. A safety policy ensures employee participation, and this was confirmed by the results, which showed that 70% agreed that employees in their firms participate in the implementation of OHSMSs.

Cost of implementation

- One important issue emerging from these findings is the cost of implementing OHSMSs. The results showed that most clients did not accept the high costs related to OHS because it is viewed by most clients as part of company overhead. These findings were consistence with previous studies [13].
- The results also indicate that the cost of OHS must be carried by the contractor, making it difficult to successfully implement an OHSMS, especially when the contractor is a small or medium enterprise with limited available capital. Most clients argue that OHS-related costs should only be charged to the client where the client has included specifications in the tender document.
- It is, however, important to note that although the cost of implementing OHSMSs can be high, there is a significant company saving due to a decrease in accidents [36].

Constrictive project durations

- Often, strict schedules and production take priority over the implementation of appropriate OHS procedures, and many employees may not fully comprehend the risks present on construction sites [53]. Constrictive project durations were found to be among the least important factors.
- Most construction sites operate on strict schedules to meet deadlines, and it is possible that by trying to meet schedules, OHS procedures may not be fully practiced.

Organisational structure

- This study also validated the previous claim made in other studies that the organisational structure was a factor that had an impact when implementing OHSMSs [17]. The structure of OHS in organisations enables all employees to be given responsibilities and functions which would allow accountability.
- The organisational structure also affects the risk and safety culture of the organisation. Usually, large companies have a low-risk and positive safety culture as compared to smaller ones, as more resources are available to invest in OHSMSs, resulting in lower risks [54]. Therefore, the type of organisational structure has an impact on the implementation of OHSMSs.

Uncertainty in reporting systems

- Uncertainty in reporting systems remains a major obstacle to implementation [13,49]. OHSMSs need to be designed with technology or hardware in mind in the initial design phase, which clearly outlines the reporting system. The lack of an ineffective information collection system poses a major challenge [55].
- To successfully implement an OHSMS and improve safety performance, construction companies must ensure that the reporting system is clear. A proper incident reporting and analysing structure is an important tool in OHSMS implementation [48].
- Retaining qualified internal auditors who are willing to address non-conformities and offer advice and suggestions is crucial. Therefore, non-conformities should be probed, and corrective actions should be proposed, whilst the potential for improvement should be identified [51].

Lack of competent workers

- Another factor emerging from these findings was the lack of competent workers. The lack of knowledge about safety issues remains a big weakness of OHSMSs [56]. Whereas this study rated it low, this could be because most construction organisations usually subcontract specific trades, such as paintwork, plastering, etc., to third parties. Because these subcontractors are appointed on a short-term basis, this does not result in continuous training. Although this saves on training costs, it results in a lack of competent workers who have knowledge of OHS.

- There is a lack of competent workers who fully understand OHS [13]. For construction tasks to be completed smoothly, safely, and with good production quality, workers need to have strong safety awareness, professional skills, and experience [52].

Internal incentives

- The least important factor from these findings was that of internal incentives, which is supported by previous studies [20]. There is a lack of internal incentives, and the implementation of incentive programs could inspire employees to execute their OHS tasks safely. If management staff and workers receive a reward for good safety performance, they may be motivated to improve safety on sites [52].
- Construction companies must provide safety incentives and integrate them into all aspects of their safety management systems to enhance safety performance. As part of this, subcontractors could be included in safety meetings and training, and everyone involved could be given responsibility and authority.

4.2. External Factors

The findings from Table 4 listed external factors, and the mean values of the findings also showed that most of the respondents agreed that the external factors affected the implementation.

Pressure from clients on project delivery

- Often, strict schedules and production take priority over the implementation of appropriate OHS procedures [53]. The findings from the study showed that pressure from clients on project delivery was the biggest factor when implementing the OHSMSs.
- Most construction project contracts include heavy penalties for the late completion of the works and OHS is usually regarded as time-consuming. Elements of OHS regulations have an impact on production, coupled with pressure from clients on project delivery [47].
- The results from this study showed that 78% of the respondents agreed that elements of OHS regulations had an impact on production. Often, production is prioritised over safety [57]. This poses a great challenge when implementing OHSMSs, as this usually results in non-compliance. This current study also found that non-compliance with OHS regulations results in accidents on site.

Company reputation

- Further findings in this study classified the company's reputation as an important factor that would affect OHSMS implementation. Usually, smaller companies find it difficult to have a functional OHSMS without support, as they need to build on their reputation first [56].

OHS enforcement, government legislation and auditing procedures

- The findings showed that enforcement, government legislation, and auditing procedures were critical factors in implementing OHSMSs. This observation was also reported by Nowrouzi et al. [55].
- Rigorous legislation and bureaucracy had a significant effect on OHS. The high level of prerequisites in the regulations and the large amount of documentation required were found to be difficult to compile, especially in small and medium organisations [15].
- Research indicates that even though the South African Construction Regulations of 2014 impose a high level of requirements on clients, the desired benefits may not be realised without financial incentives due to the low fines and lack of enforcement [58]. The findings from this study revealed that any changes in the legislature and regu-

lations from the Department of Employment and Labour affect the implementation of OHSMSs.

Comply to regulations

- Another reason that may lead to non-compliance with OHS is the lack of awareness of OHS [3,59]. Most small and medium enterprises (SMEs) in South Africa have limited commitment to compliance with OHS [60]. Most organisations face difficulties when attempting to comply with regulations due to the high cost of implementation and maintenance [59].
- This study was able to establish that non-compliance with regulations resulted in accidents on site [59]. This aligned with previous studies that showed that non-compliance with standards resulted in unsafe working conditions, injuries, and fatalities on construction sites [61].

Support from OHS authorities

- An important issue emerging from these findings was support from OHS authorities and inspections. The findings show that even though routine OHS inspections were conducted at their organisations, there was still a need for support from OHS authorities.
- The lack of labour inspectors to oversee and inspect OHSMS implementation and the government not providing any special instruments for monitoring OHSMS implementation were crucial factors when implementing OHSMSs [17]. To assess the general effectiveness of an OHSMS, compliance audits and performance evaluations should be performed.
- The findings from this study confirmed that most organisations conducted routine OHS inspections, although the inspections were not specified as external or internal. According to the CIDB report [5], the OHS in South Africa is hampered by a lack of available statistics from the Compensation Commissioner to show the full extent of accidents and inspections.
- The findings were also consistent with previous studies that found that factors such as inadequate routine inspections on sites and unfamiliarity with regulatory obligations resulted in non-compliance [3].

External incentives

- Another external factor in the results was **external incentives**. With economic incentives, clients are more likely to implement OHSMSs on construction sites; therefore, economic incentives have a critical impact on client OHS performance [58]. If clients continue to view themselves as non-essential OHS stakeholders in the absence of financial incentives, it will prevent them from effectively participating in the implementation of OHSMSs.

International trends

- The least important factor in the present study was international trends. Trends and standards usually associate the OHS trends rating of an organisation with work-related performance, making it difficult for some organisations to obtain new contracts if they do not adjust to the latest international trends.
- The current study found it to be the lowest-ranked factor because some of the international trends have nothing to do with OHS regulations. Most organisations only pay attention to international standards, such as ISO 45001:2018, when implementing OHSMSs [17].

4.3. Implementation of the OHSMS Using the PDCA Method by Analysing Construction Risks

4.3.1. Risk Management Plan

To be efficient, effective, and simple, risk management should be incorporated into management practices and systems in construction organisations [34]. Firstly, it is important to identify occupational hazards in an organisation before implementing an OHSMS [62]. The results from the present study in Table 6 indicate that risk identification could be implemented using different methods. The most common method used in organisations during the risk identification process on site was found to be a checklist, as per Table 6. For the Brazilian construction industry, it was shown that a checklist, followed by a flowchart and brainstorming, was the most common technique used to identify risk [63].

The most common strategies used in the construction industry during the **risk planning process,** in order from most to least important, were risk mitigation/reduction, risk avoidance, contingency plans, risk acceptance, risk transfer, and risk sharing. This could be because the response strategy and approach chosen are dependent on the type of risk involved [30]. As the present study was focused on the construction industry, this may explain why the findings differed.

Concerning **risk assessments**, the results showed that quantitative risk analysis was the most common method used. A risk assessment for a project in terms of scope, time, cost, and quality is more required on complex and larger projects for a more in-depth analysis as compared to small projects [33]. This suggests that most respondents in the present study were from larger organisations or were involved in large, complex projects. The results also showed that a significant number of contractors used the method of risk categorisation. This could be because most organisations aim to develop effective risk responses [28]. Once a risk management plan is formulated, it must be integrated into the OHSMS plan using the PDCA model to ensure that all the risks are identified and planned for.

4.3.2. Implementation of OHSMSs Using the PDCA Method

Although several methods can be applied as a basis for integrating management systems, the PDCA method remains the most common method used to implement OHSMSs [35]. Based on the results of Figure 4, there is a clear linear relationship between the implementation of OHSMSs and the use of the PDCA method for their implementation. The results also showed that there was a strong relationship between the PDCA method and internal and external factors.

- **Plan:** The results from the current study show that during the plan stage, there was an improvement in risk assessments when the PDCA method was used to implement OHSMSs, as per Table 5. This can be attributed to the fact that a risk management plan is produced during the planning stage. Hence, all risks would have been identified and planned for. To be efficient, effective, and simple, risk management should be incorporated into management practices and systems in construction organisations [34].
- **Do:** The findings in the present study showed that the actual implementation of an OHSMS through the identification of a risk analysis showed a potentially positive effect on both internal and external factors. This is because this stage involves the actual implementation of an OHSMS [38].
- **Check:** An important issue emerging from these findings at the check stage was that there was also a positive relationship between both factors. This is because at this stage, an exploration of solutions to accidents is verified, and OHS checklists and audits are conducted [38]. However, no evidence of improved identification of gaps and corrective actions was detected, as the results showed a negative influence on both internal and external OHS implementation factors. The findings suggest that at this stage, OHSMS implementation would have been completed in the doing phase. Hence, those factors would only impact the doing stage.
- **Act:** Lastly, the findings indicated that continuous improvement in OHSMSs was likely to result in positive contributions to both internal and external OHS implementation. This is supported by previous studies that confirmed that analyses are conducted to identify the differences between the actual and projected results [39]. This includes determining the main causes for the variations, identifying the changes required to improve performance, and developing corrective actions to implement the changes.

Based on all these findings, construction companies that use the PDCA method to implement OHSMSs produce a better system that considers construction risks and all related factors. This is attributed to the strong relationship that exists between all these variables.

4.4. Operational Framework for Implementation of OHSMSs Using the PDCA Method

The results of the study showed that many organisations faced difficulties to various degrees when implementing OHSMSs due to both internal and external factors. Figure 5 presents an operational framework for the implementation of an OHSMS in the South African construction industry based on all the findings from this study.

- The adequate application of the recommendations presented in this study should improve the implementation of OHSMSs.
- Based on the findings, both internal and external factors are listed in order of importance. The ranking of factors will enable organisations to identify factors that they need to prioritise. Once these factors have been identified, considered, and prepared for, the implementation can start.
- The framework further shows that the implementation is conducted using the PDCA method. Since risk management is a part of OHSMSs, the risk management plan needs to be integrated into the OHSMS during the planning stage of the PDCA model.
- Once the risk management is integrated, the "plan", "do", "check", and "act" steps can commence.
- Once the OHSMS has been implemented, it needs to be checked to ensure its compliance with regulations, which is an external factor.
- The framework shows that the implementation of OHSMSs is interconnected with factors, risks, and the PDCA method. There is an interdependency between all the objectives outlined in this research.
- The framework further allows for checking the OHSM to comply with regulations during the checking stage. This is an important step, as it ensures that compliance with regulations is accounted for in the OHSMS structure.

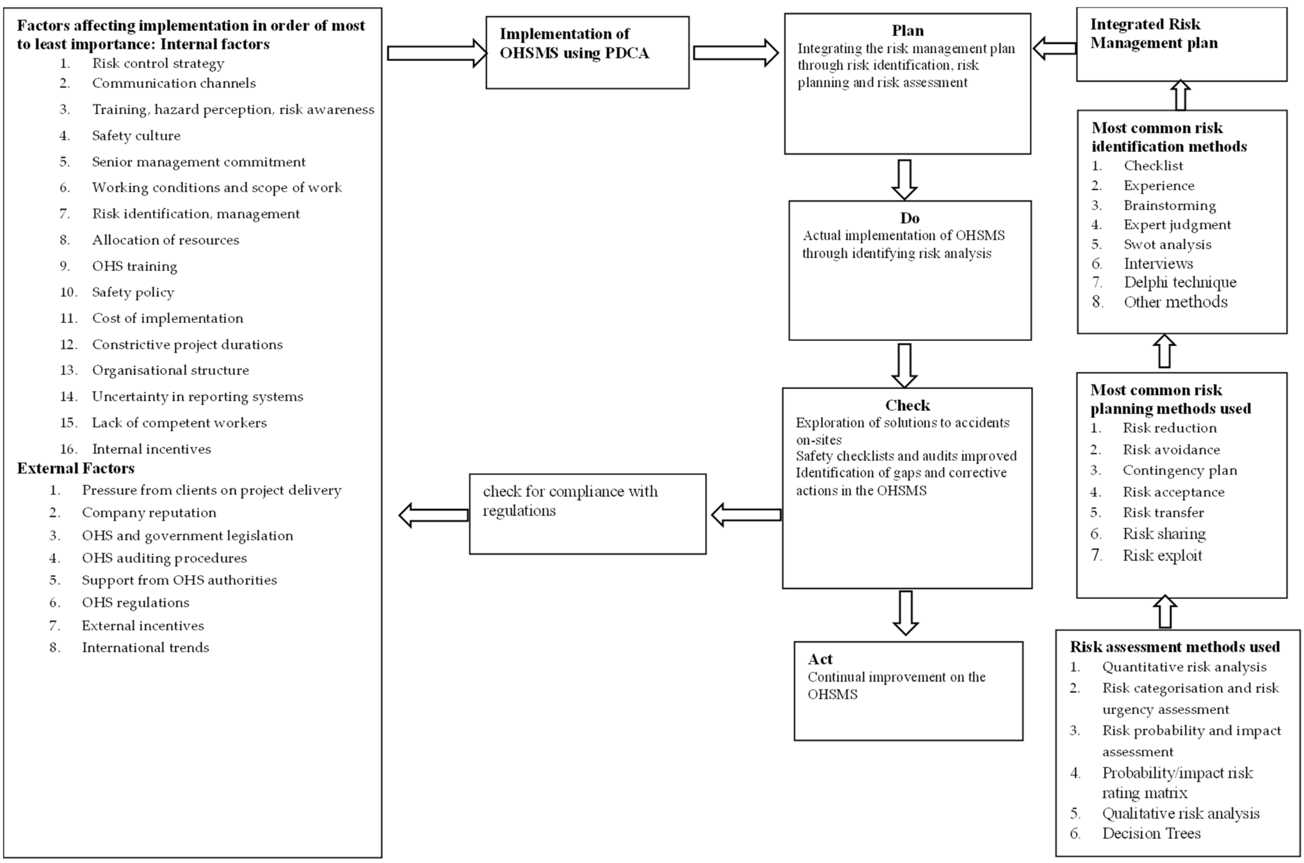

Figure 5. Operational framework for implementation of OHSMSs.

5. Conclusions

5.1. Key Findings

The construction industry remains a high-risk sector where OHS accidents are prone to occur [4]. The implementation of OHSMS is essential to address the poor workplace conditions and risks that the construction industry continues to encounter. The knowledge gap was to identify and list, in order of importance, the factors that affected OHSMS implementation in the construction industry within the Western Cape. The research accomplished this by evaluating whether organisations were considering these factors. The literature reviewed contained mostly theoretical studies, where factors were global and not specific to the construction industry. This research successfully ranked the factors applicable to the construction industry in South Africa.

The current study has increased our understanding of the barriers that should be identified and taken into consideration to successfully implement these systems. Generally, studies concerning barriers to OHSMSs were limited to systematic literature reviews and were conducted in developed countries. This research aimed to identify factors that affect the implementation of OHSMSs in the construction sector in South Africa by ranking them in ascending order.

The most important internal factors were identified as risk control strategies, senior management commitment and support, communication channels, training, hazard perception, education, risk awareness, risk identification, and safety culture.

The most important external factors were identified as pressure from clients on project delivery, company reputation, OHS enforcement, and government legislation. Often, production is prioritised over safety on most sites to achieve project deliveries or risk penalties from the client. These factors need to be accounted for and planned for during the implementation, as they have a significant effect. To best manage the implementation of OHSMSs, factors should be monitored and measured according to appropriate criteria and indicators. Therefore, focusing only on one aspect of an OHSMS can be misleading.

In previous studies, the authors did not conclude which methods could be used to implement an OHSMS for construction organisations. The results from the current study showed that the PDCA method was the most preferred method, as it would also integrate a risk management plan during the planning stage. When formulating a risk management plan, the most common method used by organisations during the risk identification process on site was found to be a checklist. In risk planning, the most common strategy used by organisations was risk mitigation/reduction, while in terms of risk assessments, the present findings showed that often a quantitative risk analysis was the most common method used during risk assessments. The organisations that used the PDCA method for implementation had good success rates as they integrated a risk management plan. This is vital as construction sites are high-risk areas where accidents are prone to occur. Using the PDCA model ensures that risks are identified, analysed, assessed, and planned for. The empirical data findings were recapped, and a framework was proposed for OHSMS implementation. The framework outlines all the factors encountered during OHSMS implementation and ways of formulating a risk management plan. The framework produced could assist the South African construction industry with the factors that they need to prioritise when implementing the OHSMS.

5.2. Limitations

The main limitation of the study was that it only focused on construction organisations located in South Africa. The construction sites were limited to residential and commercial sites. Furthermore, the data were interpreted with the SPSS, and the research method was quantitative. The data collection from construction professionals was cumbersome due to the demanding schedules of the respondents, as construction projects tend to have tight schedules. Hence, the response and participation took longer to receive, which is a presumptive known fact in the construction industry.

5.3. Recommendations for Future Research

It may be beneficial for future studies to test the framework produced and conduct similar studies to compare the results. The OHSMS factors could then be measured and monitored to calculate the degree of effect on OHSMS implementation. Further research could be conducted on how to maintain and improve the OHSMS that would have been implemented. This could be supported by identifying different steps that organisations take when implementing an OHSMS, as the framework is not generic and depends on organisational needs [11]. Future research could also be conducted on ways to navigate and plan for these factors and support the organisations so that the industry can reduce the challenges they face with OHSMS implementation. This could be beneficial, especially to SMEs, which tend to face resource challenges when implementing an OHSMSs.

Future studies could benefit from a comparative approach, perhaps contrasting the South African context with other developing countries to provide a broader understanding of the challenges and strategies in OHSMS implementation. Incorporating qualitative research methods could offer better insights into the experiences and perceptions of professionals regarding OHSMSs, complementing the quantitative data.

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