

# Integration of ISO 45001 and Project Management Institute's Project Management Body of Knowledge in Construction Project Management

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## Abstract

The integration of Occupational Health and Safety (OH&S) management and project management is not a new topic. However, with the new ISO 45001 international standards for OH&S management recently launched in 2018, a structured literature review is timely to assess the available body of knowledge, develop new ideas and deliberate future research inferences between ISO 45001 and Project Management Institute's (PMI) Project Management Body of Knowledge (PMBOK). A structured literature review was conducted using OH&S management keywords (ISO 45001, OSHA 18001, OHS, OH&S) against project management keyword (PMBOK), where the articles search was further refined, classified and analysed. This paper hence aims at appraising the conceptual integration of ISO 45001 and PMBOK in construction project management by investigating conceptual approaches on how ISO 45001 and PMBOK can be integrated and examining the current status of the existing literature on ISO 45001 and PMBOK. It was found that ISO 45001 is easier to overlay on PMBOK rather than the inverse. The paper also found that there is a lack of published literature on the integration of ISO 45001 and PMBOK and the inclusion of its predecessor which is OSHA 18001 was required. However, it is noted that even with a larger number of papers reviewed, the findings were largely inconsistent (heterogeneous) in terms of objectives, methodologies and results. Additional research into relationship model(s), as well as application of new technologies and digital application is recommended to complete the outlook for the integration of both systems.

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## 1. Introduction

Although the topic of Occupational Health and Safety (OH&S) and project management has been discussed since the 1980s [1] whilst various methods and management systems are developed and applied to each subject, the importance of integration of both topics specifically in construction projects has been consistently increasing over the years. There are thousands of

publications dealing with OH&S and project management, yet with the new ISO 45001 (2018) international standard for OH&S management replacing the OSHA 18001 (2007), it is worth to discuss this ISO 45001 (2018) in depth.

On the other hand, an extensive list of literature providing professional guidelines and framework for best practices in project management is available. One of the

most adapted frameworks is provided by The Project Management Institute (PMI) as set out in their Project Management Body of Knowledge (PMBOK), which was approved by The American National Standard Institute (ANSI) as an American National Standard (ANSI)[3].

Therefore, a detailed investigation into the current status of existing literature on the new ISO 45001 and PMBOK is timely, hence, this paper comes into existence aiming at investigating the conceptual integration of ISO 45001 and PMBOK and the current status of the existing body of knowledge on ISO 45001 and PMBOK.

## 2. Review on Iso 45001 and Pmi Pmbok

### ISO 45001

With considerations of other standards such as OHSAS 18001 (2007), the International Labour Organisation’s ILO-OSH 2001 guidelines, international and national standards and conventions, ISO 45001 (2018), Occupational Health and Safety Management Systems – Requirements with Guidance for Use, is the world’s first International Standard for OH&S [2]. Both ISO 45001 and OHSAS 18001 standards have the same aims in improving Occupational Health and Safety (OH&S) performance. In preventing work-related injury and ill health, ISO 45001 uses the same common text and high-level structure (known as Annex SL) as standards, similar to the ISO 9001 and 14001. The adoption of this new standard will bring OH&S management and continual improvement deeper into the core of an organisation [4]. The seven main elements in the new ISO 45001 includes context of the organisation, leadership and worker participation, planning, support, operation, performance

evaluation, and improvement [6]. It provides a standard to increase safety, reduce workplace risks and enhance health and well-being at work, enabling an organisation to proactively improve its OH&S performance. The main role of ISO 45001 standard serves as a useful instrument to enable an organisation to proactively improve its OH&S performance, regardless of size, type and the nature of the organisation [5].

### PMI PMBOK

The Project Management Body of Knowledge ® Guide (PMBOK ® Guide) is a guide to the Project Management Institute’s (PMI) project management body of knowledge, where the contents are applicable to most projects including construction. 49 processes are described with each of these processes having descriptions for inputs, tools and techniques as well as outputs. These processes are then divided into the ten knowledge areas under PMBOK across five process groups or stages of the project life cycle [7].

PMI created a set of knowledge principles in project management based on project management methodology, which was defined in the late 1960s and 1970s by the standards of the United States (US) Army that was later adopted to become the US industry standards [8]. PMBOK also notes that understanding of the application area, the project environment, general management knowledge and skill, and interpersonal skills are also required for effective project management [9]. The latest version is currently the PMBOK 6th edition, which was released in September 2017 as shown in Table 1.

Table 1: PMBOK 6th Edition Project Management Process Group and Knowledge Area Mapping [7]

Knowledge Area	Project Management Process Group				
	A (Initiating)	B (Planning)	C (Executing)	D (Monitoring and Controlling)	E (Closing)
<b>I (Project Integration Management)</b>	Develop Project Charter	Develop Project Management Plan	- Direct and Manage Project Work - Manage Project Knowledge	- Monitor and Control Project Work - Perform Integrated Change Control	Close Project or Phase
<b>II (Project Scope Management)</b>		- Plan Scope Management - Collect Requirements - Define Scope - Create WBS		- Validate Scope - Control Scope	
<b>III (Project Schedule Management)</b>		- Plan Schedule Management - Define activities - Sequence activities - Estimate		Control Schedule	

		Activity Resources - Estimate Activity Durations - Develop Schedule			
<b>IV (Project Cost Management)</b>		- Plan Cost Management - Estimate Cost - Determine Budget		Control Costs	
<b>V (Project Quality Management)</b>		Plan Quality Management	Manage Quality	Control Quality	
<b>VI (Project Human Resource Management)</b>		- Plan Resource Management - Estimate Activity Resources	- Acquire Resources - Develop Team - Manage Team	Control Resources	
<b>VII (Project Communication Management)</b>		Plan Communications Management	Manage Communications	Monitor Communications	
<b>VIII (Project Risk Management)</b>		- Plan Risk Management - Identify Risk - Perform Quantitative Risk Analysis - Perform Quantitative Risk Analysis - Plan Risk Responses	Implement Risk Responses	Monitor Risks	
<b>IX (Project Procurement Management)</b>		Plan Procurement Management	Conduct Procurements	Control Procurements	Close Procurement
<b>X (Project Stakeholder Management)</b>	Identify stakeholders	Plan Stakeholder Engagement	Manage Stakeholder Engagement	Monitor Stakeholder Engagement	

### 3. Methodology

As the topic of incorporation of OH&S management and project management (specifically looking at the ISO 45001 and PMBOK) is relatively new due to the recent launch of the ISO 45001 standard, a structured literature review is conducted on the topic to develop propositions and discuss future research implications following the suggestion by [10]. This method is applied due to the small number of publications available related to the integration of these two systems of interest. Systematic literature review adopted from [11] as well as formulation of reviewed questions, location of research articles, selection and evaluation of articles, classification and analysis of the content as well as use of the results as a synthesis, adopted from [12] are implemented entirely in this paper.

The first maps the seven elements of ISO 45001 system against the Project Management Body of Knowledge (PMBOK) 49 processes and ten knowledge areas to gain overall understanding on the applicability and integration of both systems. The second analyses the literature available in terms of instruments, requirements and results. A structured literature review was conducted using OH&S management keywords (ISO 45001, OSHA 18001, OHS, OH&S) against project management keyword (PMBOK). The literature is categorised to examine the available knowledge on ISO 45001 and PMBOK and their application in construction project management. The classification is based on the theme of the papers, which fall into one of the following categories: integration, sustainability, risk assessment and generic as proposed by the paper. Subsequently, the literature is addressed, where the variables used in the content analysis are shown in Table 2.

Table 2: Variables used in content analysis

Findings and Reason for Exclusion	Number (of Exclusions)
Articles found based on keywords	747
Articles in foreign language	-499
Matching Items (both keywords and construction in title, abstract and/or text)	66
Restricted or no access	-4
Citations	-3
Thesis	-14
Total number of articles	45

### 4. Findings and discussion

#### Classification of Literature

45 papers were identified based on the criteria, segregated into four themes: generic (15 papers), integration (12

papers), risk (16 papers) and sustainability (5 papers). The first and most basic group comes under generic, where the papers mention the use of ISO45001/OSHA18001 and PMBOK in construction/development projects. Generally, PMBOK is applied as a guideline to manage the project while ISO45001/OSHA18001 is the OH&S standard used in that project. Papers in this section discussed the use of OH&S management systems and PMBOK to improve project performance [13] and strategic project management practices [14] including OH&S management.

The second group (integration) specifically describes the integration of OS&H management (ISO45001/OSHA18001) and PMBOK into an Integrated Management System (IMS). IMS is adopted as an effective approach to align and integrate the various requirements of different certification systems with diverse normative management system requirements [15]. According to [1], the integration of OS&H management and project management has not developed systematically in the various fields although changes and improvements of laws and management system are in place.

The third group under risk specifically addresses papers describing the use of risk, risk assessments and integration of OH&S risk in project risk, where this is the largest group with 16 papers. According to [16], the level of risk originating internally in a project is related to the project management maturity of the project and its host organisation and that significant project risk is often generated within projects (rather than from external factors or the nature of the project task), but that such risks are seldom managed effectively. On the contrary, [17] indicated that although risk management tools are in place, many major projects have run into difficulty because of a failure to integrate OH&S. Various tools were proposed and discussed in the papers, including Building Information Modelling (BIM), Latin hypercube simulation, Analytic Hierarchy Process (AHP), hazard rating, activity based risk assessment and specific risk assessment model.

Finally, the sustainability group is discussed on the use of certification as a tool to develop sustainability of OH&S management in project management [18], verify how OH&S sustainability management impacts the project success [19] and examine challenges of introducing OH&S sustainability in projects [20]. The literature in this criteria is the most recent which can be attributed to the increase in prominence of sustainable development where papers being published from 2014 up to 2018.

#### ISO 45001 and PMBOK Integration

The integration begins by comparing the methodologies at the high level by looking at the knowledge area in Project Management Body of Knowledge (PMBOK) against the coverage of ISO 45001 and vice versa. Table 3 and Table 4 map the main characteristics between ISO 45001 and PMBOK and vice versa, which have clearly

shown many significant overlapping entries in terms of ISO structure and PMBOK processes. This may be the first time that this type of comparison has been conducted and it clearly shows that ISO 45001 is easier to overlay on PMBOK rather than PMBOK overlaid on ISO 45001.

This can be attributed to PMBOK having already taken into account the OH&S requirements across the five stages as well as having a specific section on project safety management process in which is detailed in the Chapter3 of PMBOK® Guide [15].

Table 3: ISO 45001 coverage of PMBOK

PMBOK Knowledge Area	ISO 45001 Coverage
<b>I (Project Integration Management)</b>	<u>4 Context of organisation</u> 4.3 Determine the scope of OH&S management system 4.4 OH&S management system <u>5 Leadership and worker participation</u> 5.2 OH&S policy <u>6 Planning</u> 6.1.4 Planning action 6.2 OH&S objectives and planning to achieve them 6.2.1 OH&S objectives 6.2.2 Planning to achieve OH&S objectives <u>8 Operation</u> 8.1 Operational planning and control 8.1.3 Management of change <u>10 Improvement</u> 10.1 General 10.2 Incident, nonconformity and corrective action 10.3 Continual improvement
<b>II (Project Scope Management)</b>	<u>Context of organisation</u> 4.1 Understand the organisation and its context 4.3 Determine scope of OH&S management system <u>6 Planning</u> 6.1.2 Determine legal and other requirements 6.2 OH&S objectives and planning to achieve them 6.2.1 OH&S objectives 6.2.2 Planning to achieve OH&S objectives
<b>III (Project Schedule Management)</b>	<u>6 Planning</u> 6.1.4 Planning action 6.2.2 Planning to achieve OH&S <u>7 Support</u> 7.1 Resources <u>8 Operation</u> 8.1 Operational planning and control
<b>IV(Project Cost management)</b>	<u>7 Support</u> 7.1 Resources
<b>V (Project Quality Management)</b>	<u>7 Support</u> 7.5 Documented information 7.5.1 General 7.5.2 Create and update 7.5.3 Control of document information <u>9. Performance evaluation</u> 9.1 Monitor, measurement, analysis and performance evaluation 9.2 Internal Audit <u>10 Improvement</u> 10.1 General 10.2 Incident, nonconformity and corrective action 10.3 Continual improvement
<b>VI(Project Human Resource Management)</b>	<u>7 Support</u> 7.1 Resources 7.2 Competency 7.3 Awareness

<b>VII (Project Management)</b>	<b>Communication</b>	<u>7 Support</u> 7.4 Communication 7.4.1 General 7.4.2 Internal communication 7.4.3 External communication
<b>VIII (Project Risk Management)</b>		<u>6 Planning</u> 6.1 Actions to address risks and opportunities 6.1.1 General 6.1.2 Hazard identification and assessment of risk and opportunities 6.1.3 Determination of legal and other requirements 6.1.4 Planning action <u>8 Operation</u> 8.2 Emergency preparedness and response <u>9 Performance evaluation</u> 9.3 Management review
<b>IX (Project Management)</b>	<b>Procurement</b>	<u>8 Operation</u> 8.1.4 Procurement
<b>X (Project Stakeholder Management)</b>		<u>4 Context of organisation</u> 4.1 Understand organisation and its context 4.3 Understand needs and expectations of workers and other interested parties <u>5. Leadership and work participation</u> 5.1 Leadership and commitment 5.3 Organisational roles, responsibility and authorities 5.4 Consultation and Participation of workers.

Table 4: PMBOK coverage of ISO 45001

ISO 45001 Elements	PMBOK Coverage
Context of the organisation	<u>Project Scope Management</u> Plan Scope Management Define Scope Validate Scope Control Scope <u>Project Stakeholder Management</u> Identify stakeholders Plan Stakeholder Engagement Manage Stakeholder Engagement Monitor Stakeholder Engagement
Leadership and worker participation	<u>Project Integration Management</u> Develop Project Charter Direct and Manage Project Work Manage Project Knowledge
Planning	<u>Project Integration Management</u> Develop Project Management Plan <u>Project Scope Management</u> Plan Scope Management <u>Project Schedule Management</u> Plan Schedule Management Estimate Activity Resources Estimate Activity Durations Develop Schedule <u>Project Cost Management</u> Plan Cost Management

	<p>Estimate Cost Determine Budget <u>Project Quality Management</u> Plan Quality Management <u>Project Human Resource Management</u> Plan Resource Management Estimate Activity Resources <u>Project Communication Management</u> Plan Communications Management <u>Project Risk Management</u> Plan Risk Management Plan Risk Responses <u>Project Procurement Management</u> Plan Procurement Management <u>Project Stakeholder Management</u> Identify stakeholders Plan Stakeholder Engagement</p>
Support	<p><u>Project Human Resource Management</u> Plan Resource Management Estimate Activity Resources <u>Project Communication Management</u> Manage Communications Monitor Communications</p>
Operation	<p><u>Project Integration Management</u> Direct and Manage Project Work Monitor and Control Project Work Perform Integrated Change Control</p>
Performance evaluation	<p><u>Project Integration Management</u> Monitor and Control Project Work <u>Project Communication Management</u> Monitor Communications <u>Project Stakeholder Management</u> Monitor Stakeholder Engagement</p>
Improvement	<p><u>Project Integration Management</u> Perform Integrated Change Control</p>

This safety management process encompasses all activities by the sponsor/owner of the project on the organisation to ultimately govern the safety policies, project objectives, as well as roles and responsibilities in which the project is planned and performed for accidents prevention, which can(or have the potential to) cause harm including injuries, deaths, or asset damage. The safety management term is also defined by [7] in safety management and health management in the Construction Extension of PMBOK. It is noteworthy that the interactions between all aspects of project management

and project safety management are based principally on stakeholder's communications.

### 5. Conclusion

This paper provides an overview of the conceptual integration of ISO 45001 and Project Management Body of Knowledge (PMBOK) as well as the current status on the implementation of Occupational Health and Safety (OH&S) management, namely ISO 45001 (2018) and

project management guideline specifically PMBOK in construction project management. The analysis of the current body of knowledge found that there is a need to go back to the predecessor of ISO 45001, which is the OSHA 18001, due to lack of papers available on the subject. Since the new ISO standard is still infant, there is a definite lack of knowledge in this area. It is noted that publications on this subject comes mainly from the construction industry and even with a larger number of papers reviewed, the findings were largely inconsistent (heterogeneous) in terms of objectives, methodologies and results. The integration of OS&H management and project management has not developed systematically in various industrial fields even though changes and improvements laws and management system are taking place. Nevertheless, there is a general move towards integrated management system for construction project management and this should be the direction taken moving forward. Yet, it needs to be noted that OH&S risk generated from within the construction project needs to be adequately addressed through proper risk assessments in the new integrated management system to ensure that this is efficiently managed.

Although the application of both ISO 45001 and PMBOK will improve project performance, there are many variables that need to be looked into. Hence, the need to have a relationship model(s) can be an interesting research topic. In completing the overview of OH&S management and project management integration, it is suggested that future research investigates innovative OH&S digital application, which is currently being used for project management in the construction industry.

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