# An Audit Exercise to Identify Gaps in the Implementation of Construction Site Management Practices through Observational Data Collection

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Dedicated to all who hold faith that the Maltese construction industry can be improved and revitalized, and to the memory of those who have tragically lost their lives due to industry negligence, especially the late Jean Paul Sofia.

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# Abstract

This research evaluates the present level of building site management procedures in Malta by using a benchmarking exercise that compares optimal practice to the UK construction sector. The motivation stems from persistent issues of failure in Malta's construction sector, including building collapses and worker fatalities. Despite regulatory revisions and proposals for a comprehensive construction framework, significant gaps in site management remain unaddressed, necessitating a thorough evaluation.

The research aims to identify discrepancies between Maltese and UK best practice, to analyse how these differences impact compliance with local legislation and industry standards, and propose actionable recommendations to improve site safety, efficiency, and regulatory adherence. Utilising a deductive research approach, the study draws on data from construction projects, an audit checklist compiled on themes identified in a literature review, and transcribed data from key stakeholders in medium-scale construction projects locally.

This multi-method approach combines observational data collection and interview data from 8 case studies, focusing on parameters related to: site organisation, physical and mental well-being, material and environmental management, and communication practices. Thematic analysis reveals critical gaps in Maltese practices in all the five themes examined. Findings indicate a pressing need for a robust regulatory framework, improved site management standards, and enhanced training programs.

Recommendations emphasise adopting UK best practices tailored to the Maltese context, strengthening regulatory oversight, and fostering a safety-centric culture in the construction industry. This dissertation contributes to the ongoing discourse on construction site management in Malta, offering insights for policymakers and industry practitioners aimed at mitigating risks and enhancing project outcomes.



**Keywords:** Construction site management practices, gaps, recommendations and audit process

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# 1. Introduction, Background and Context

## 1.1. Background and Context

In recent years, Malta's construction industry has faced severe issues, including building collapses and worker fatalities. Notably, the government halted all demolition and excavation works in 2019 to urgently revise construction-related legislation (Grech, 2019). Despite these efforts, such quick amendments were criticised as insufficient. In response, Kamra tal-Periti released "A Modern Building and Construction Regulation Framework" in 2020, proposing comprehensive reforms based on successful systems from other countries. This document highlighted the industry's critical problems and offered solutions, urging immediate action as the situation was deteriorating and lives were being lost (Kamra tal-Periti, 2020). However, despite broad support from various stakeholders, these proposals remain largely unimplemented.

The situation continued to deteriorate, culminating in the death of worker Jean Paul Sofia on December 3, 2023, when a partially constructed factory collapsed. This incident, and the ensuing public outcry led by Sofia's mother, emphasized the dire need for reform. Construction site practices are pivotal for project success and worker safety. Therefore, this dissertation aims to investigate current site practices to evaluate the situation and identify if any improvements have been made, addressing the urgent need for effective regulation and safer construction practices in Malta.

## 1.2. Aims and Objectives

This study aims to identify and highlight gaps in Maltese construction site practices compared to ideal practices in the UK, derived from the literature review. Additionally, the current Maltese regulations are analysed to see how they encourage the derived best practices. Moreover, the research focuses on variations from established standards and legislation within Malta's construction industry. By pinpointing these discrepancies, with this triangulation of data, the study informs recommendations for improving legislative frameworks and industry practices. The overarching goal is to enhance safety, efficiency, and compliance on Maltese construction sites, promoting good governance and aligning local practices more closely with international standards.


**Figure 1: Triangulation of Data**

## 1.3. Research Questions

The research questions being investigated are the following:

1. What are the prevalent gaps in Maltese construction site practices identified when compared to the ideal construction site practices in the UK?
2. How do these variations compare with established standards and legislations currently employed in the Maltese construction industry?
3. How can the identified gaps in the implementation of construction site practices inform recommendations for improvements in both legislation and industry practices, with the aim of enhancing overall safety, efficiency, and compliance on construction sites and promoting good governance?

## 1.4. Research Method Overview

This research adopts a deductive approach to theory development, leveraging existing knowledge from a literature review on optimal UK construction site practices to inform an audit checklist and guide semi-structured interviews. The methodological choice primarily emphasizes qualitative methods to explore and interpret complex site behaviours through a multi-method approach. Multiple-case studies are selected to analyse medium-scale construction projects during their civil works phase, focusing on roles such as project managers and site managers. Data collection combines observational studies for real-time insights and transcribed interviews for a deeper understanding, following a structured audit process informed by themes from the literature. Observational checklists and flexible interviews ensure comprehensive data on-site organization, well-being, material and environmental management, and communication. Thematic analysis of the collected data, involving coding and pattern identification, provides a narrative that aligns with the research objective of understanding and improving construction site practices.

## 1.5. Dissertation Structure

This dissertation is structured into four main chapters, excluding the introductory chapter. The first chapter, the Literature Review, begins by providing an overview of construction site management practices, addressing perceived perceptions and highlighting key issues. It explains the rationale for focusing on the UK to identify best practices and synthesizes these practices from various scholarly arguments. The chapter concludes by examining the current Maltese regulations, comparing them to the identified best practices, and discussing their applicability or lack thereof in the Maltese context.

The Methodology chapter outlines the research approach, detailing the chosen methods for data collection and analysis, and explaining how observations and interviews were formulated. It also discusses the process of participant selection for both observations and

interviews. Ethical considerations, validity of the methods used, and study limitations are addressed.

The Results & Discussion chapter presents the findings, which are analysed and discussed in detail. This section provides a descriptive and explanatory analysis, linking the results back to the literature review and answering the research questions.

The final chapter, the Conclusion chapter, summarises the overall results and conclusions of the study. It evaluates the study critically, highlights potential improvements, and offers recommendations based on the findings.

# 2. Literature Review

## 2.1. Introduction to Construction Site Management

### 2.1.1. Definition of Construction Site Management

Site management involves coordinating tasks to transform raw materials into a final product. This includes organizing resources, managing information and finances, and optimizing site operations for profitability, efficiency, and quality (Construction, 1996). Griffith and Watson (2004) identify site management as comprising initial preparations, site layout, and welfare services, essential for successful project execution (Griffith & Watson, 2004). The site management team's role encompasses arranging, communicating, coordinating, and motivating site operations (Ashworth, 2006). Site managers must effectively handle resources, schedules, regulations, and safety while resolving issues, aiming to keep the project on time and within budget (Dube et al., 2015).

### 2.1.2. Importance of Good Construction Site Management to a Project

Construction site management encompasses a multifaceted approach to overseeing the factors influencing construction outcomes. These factors, including project duration, overall cost, and quality standards, are intricately interconnected and collectively contribute to the success or failure of a project. Depicted in models like the 'Production Triangle' or 'Iron Triangle,' shown in figure 2, these elements serve as crucial benchmarks for evaluating site management performance. (Sherratt & Farrell, 2022)

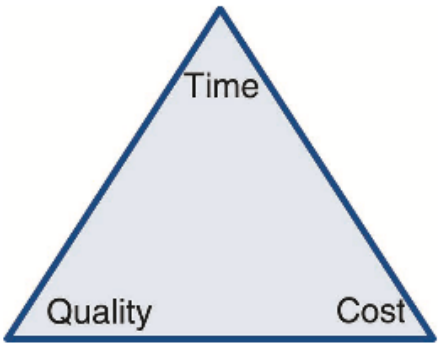


**Figure 2: The 'iron' triangle.**

Source: (Sherratt & Farrell, 2022)

Effective site management procedures encompass essential elements such as site organization, policies, planning, supervision, and communication facilitation. By adhering to these practices, construction projects can navigate challenges and enhance their chances of achieving desired outcomes. (Newcombe et al., 2022)

Walker (1997) highlights that achieving quality standards in construction requires structured systems prioritizing cost, time, and quality. Meticulous documentation of site events is crucial for efficient management and decision-making (Walker, 1997) (Dube et al., 2015). Obiegbu (2012) stresses that effective site management optimizes resources, maintains quality, ensures safety, and fosters stakeholder relationships, which helps prevent delays and disruptions (Dube et al., 2015).

Modern construction management demands efficiency in managing projects and sites, budget adherence, timelines, quality work, safety, environmental protection, and legal compliance. The construction site is critical for efficient resource allocation, information flow, and financial control, driving profitability and productivity (Sherratt & Farrell, 2022). Effective site management involves organizing the site, setting policies, planning, supervising, and facilitating communication to navigate challenges and achieve project success (Newcombe et al., 2022).

## 2.2. Best Construction Site Management Practices as Baseline Data

### 2.2.1. General overview of CSM Practices in EU countries

The construction industry in the European Union (EU) is governed by a framework of regulations designed to enhance safety, worker protection, and operational efficiency. The Occupational Safety and Health (OSH) Directives of the European Union, which set minimum safety requirements that are applicable to all member states, provide the foundation of these rules. Although the purpose of these directives is to provide a unified approach to safety in high-risk industries such as construction, individual member states are free to modify these requirements, leading to notable differences in construction site practices within the European Union.

Germany displays best practices in construction site management by prioritising safety via its Construction Site Ordinance (Baustellenverordnung). This rule requires rigorous adherence to safety standards, which contributes to lower accident rates than other EU nations (Piper, 2024). Additionally, Germany's comprehensive training programs equip workers with essential skills in material management and environmental sustainability, fostering a culture of safety and efficiency (A. Muller, 2019).

Sweden also exemplifies excellent building site procedures, notably the proactive attitude of the Swedish Work Environment Authority (Arbetsmiljöverket), which emphasises prevention in health and safety management (OECD, 2021). The integration of advanced technologies, such as Building Information Modeling (BIM), enhances communication and project coordination, thereby reducing delays and minimizing resource wastage (Matthei, 2021).

The UK is another good example, with the Health and Safety Executive (HSE) implementing stringent laws that require detailed training and risk assessments in building. These procedures have drastically lowered the accident rates (HSE, 2023). The adoption of BIM

technology in the UK further enhances site organization and communication, leading to more efficient project delivery (Gyarteng, 2014). These nations not only demonstrate effective site management but also set benchmarks for others to aspire to.

In contrast, countries such as Bulgaria and Romania have significant hurdles in their building site procedures. Bulgaria, for example, has one of the worst rates of workplace accidents in the EU, which are ascribed to weak implementation of health and safety standards and a lack of worker training (EU-OSHA, 2022). These deficiencies result in poor site organization and undermine overall project efficiency.

Similar problems with poor material management and environmental standards plague Romania's building industry, as seen by the country's low use of sustainable materials and serious stakeholder communication breakdowns (European Commision, 2021). These factors exacerbate inefficiencies and contribute to a fragmented approach to site management.

Italy has unique difficulties because of the inconsistent application of laws that raise serious questions about public health and safety. Inadequate training and site organisation have been connected to high incidence of workplace accidents, resulting in a disjointed management strategy that differs by location (Eurostat, 2024).

Greece also struggles with poor construction site practices, primarily due to economic constraints and regulatory lapses (European Agency for Safety and Health at Work, 2020). Degradation of the environment is a result of ineffective material management systems, especially in metropolitan areas where building disturbs nearby ecosystems (Evangelinos et al., 2009).

### 2.2.2. Justification for Selecting the UK as a Benchmark

In order to establish optimal construction site management practices, evaluating countries with exemplary standards is crucial. Elena Pace's dissertation entitled, “A Comparative Review of Construction Site Management Practices: Malta and other Countries” (Pace, 2020), identifies the UK as a leader in site management. This conclusion, derived from a mixed-methodology approach with constructive feedback from participants, highlights the UK's superior practices. The following section draws on literature, industry reports, and empirical evidence to explore the key factors that affirm the UK's leading position in construction site management.

### 2.2.3. Regulatory Frameworks

The UK is recognised for its exemplary construction site management practices, largely due to its robust regulatory frameworks. Organizations such as the Construction Industry Training Board (CITB) and the Health and Safety Executive (HSE) enforce stringent health, safety, and environmental regulations. A key piece of legislation is the Construction (Design and

Management) Regulations of 2015, which mandates legal obligations for various stakeholders in construction projects to ensure effective risk management. HSE research highlights the positive impact of these regulations in reducing accidents and injuries in the sector. The UK regulatory framework also emphasizes continuous improvement and adaptation to emerging challenges, as exemplified by the 'Site Operating Procedures' issued during the COVID-19 pandemic by the Construction Leadership Council (CLC), which leads efforts to transform the industry in alignment with the government's Construction 2025 Strategy. This strategy includes sustainability initiatives led by bodies such as the Green Construction Board. The Construction Industry Council (CIC) provides a unified platform for diverse professional bodies and associations, advocating for construction professionals' interests. Build UK represents a significant portion of the construction sector, collaborating with government and safety entities to support smaller contractors and the supply chain. Constructing Excellence (CE), formed from the consolidation of various industry bodies, promotes sector improvement through research and demonstration projects, working closely with organizations like the Building Research Establishment (BRE). Together, these bodies support the UK's position as a leader in construction site management through advocacy, research, and adherence to evolving standards.

### 2.2.4. Integration of Technology

To enhance site management procedures, the UK construction sector has been at the forefront of embracing and incorporating technological advancements. An excellent illustration of this kind of innovation is Building Information Modelling (BIM). Better coordination, collision detection, and decision-making result from stakeholders working together to jointly design, visualise, and simulate building projects in a digital environment using BIM (Arayici et al., 2018). Adoption of BIM may greatly improve project performance in terms of cost, time, and quality (Azhar et al., 2017). Additionally, the UK government has taken the lead in advancing digital transformation in the building industry by launching programmes like the Construction Sector Deal and the Digital Built Britain (HM Government, 2019). These programmes highlight the strategic significance of technical innovation in boosting output and effectiveness throughout the value chain of the construction sector.

### 2.2.5. Industry Standards

Strict industry rules of conduct and standards are followed by the UK construction sector, providing guidelines for efficient site administration. The Royal Institute of Chartered Surveyors (RICS), for example, releases guidelines and standards that address many facets of managing construction projects, such as ethics, risk management, and procurement (RICS, 2024). These standards give experts precise instructions on how to carry out their duties in a way that preserves professionalism, quality, and integrity. Furthermore, industry associations

like the Institution of Civil Engineers (ICE) and the Chartered Institute of Building (CIOB) are essential in establishing and advancing best practices in construction management. Their studies and publications help the industry share information and experience, which promotes ongoing advancements in site management techniques.

### 2.2.6. Project Delivery Techniques

Modern project delivery approaches are used by the UK construction sector, which places a high priority on value generation, efficiency, and teamwork. One such strategy is Integrated Project Delivery (IPD), which starts a project's collaborative work from the outset by bringing together important project stakeholders, such as owners, contractors, and designers (Fischer et al., 2017). It has been demonstrated that IPD enhances decision-making processes, lowers conflict, and aligns incentives to better project outcomes. Moreover, to stimulate innovation and productivity in the sector, the UK government's Construction 2025 plan promotes the application of Lean Construction principles (HM Government, 2013). Lean Construction aligns with the objectives of efficient site management methods by emphasising waste removal, continual improvement, and value generation.

### 2.2.7. Universities and Research

The United Kingdom is distinguished by its prestigious universities offering leading programs in construction management. Notable institutions like the University of Cambridge, Imperial College London, and the University of Oxford rank among the world’s top universities, providing exceptional research and educational opportunities in this field. These universities host eminent faculty members, including Professor Andrew Dainty from Loughborough University, renowned for his research on organizational culture, innovation, and safety in construction (Loughborough University, 2024), and Professor Peter Barrett from the University of Salford, noted for his work on project success factors and performance measurement (Barrett, 2024). The expertise and contributions of these scholars reinforce the UK's status as a global centre for construction management knowledge and education.

### 2.2.8. Summary

The United Kingdom excels in construction site management, demonstrated by its stringent regulatory frameworks, technological innovations, adherence to industry standards, and modern project delivery methods. Key factors include strict regulations like the CDM Regulations, the adoption of advanced technologies such as Building Information Modelling (BIM), and the support of industry norms by organizations like RICS. Initiatives such as Construction 2025 further highlight the UK’s commitment to contemporary practices. Additionally, the presence of esteemed academics at UK universities bolsters its global reputation as a leader in construction management expertise and knowledge dissemination.

## 2.3. Review of Literature and Criteria Development

### 2.3.1. Review of Construction Site Practices by Various Authors

The Chartered Institute of Building (CIOB), which is a professional body in the UK specializing in construction management and leadership, underscores the essence of construction management, emphasizing the coordination of stakeholders to enhance the built environment while adhering to global standards (CIOB, 2024).

In the realm of construction site management, various scholars and experts have articulated distinct frameworks and practices aimed at achieving efficient project outcomes. Mohamed and Anumba (2006) from Loughborough University propose a comprehensive conceptualization that underscores the critical components of material handling, equipment management, and workforce proficiency (Mohamed & Anumba, 2006). They categorize optimal site management practices into six sub-processes, encompassing areas such as supervision, administration, and health and safety management (Dube et al., 2015).

Fred Sherratt (2022) expands on these foundational elements by emphasizing the essentiality of time, cost, and quality management alongside considerations for health, safety, mental well-being, and environmental sustainability. Sherratt introduces the "Production Triangle," highlighting the intricate interplay of time, cost, and quality within construction management, while also stressing the growing significance of environmental and human factors in shaping project outcomes (Sherratt & Farrell, 2022).

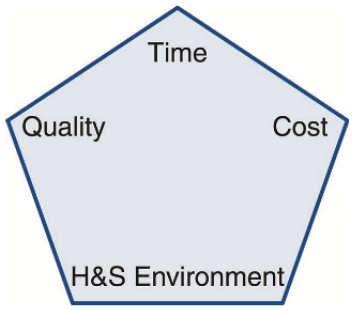


**Figure 3: Production Management Pentagon**

Source: (Sherratt & Farrell, 2022)

Further enhancing the discourse, Barry Fryer (2004) and Griffith and Watson (2004) present structured frameworks that encompass leadership, teamwork, efficient site logistics, communication strategies, quality assurance, and environmental stewardship as crucial elements for effective construction project management. Their insights underscore the multifaceted nature of site management, emphasizing the integration of diverse elements to ensure project success (Fryer, 2004) (Griffith & Watson, 2004).

These perspectives collectively argue for a holistic approach to construction site management, where adherence to established practices not only enhances operational efficiency but also

mitigates risks, promotes sustainability, and ensures stakeholder satisfaction. By integrating rigorous management practices with evolving considerations such as environmental stewardship and worker well-being, construction managers can navigate complexities effectively, ultimately achieving sustainable project outcomes.

### 2.3.2. Identification of Construction Site Management Best Practices

Upon comprehensive analysis of the above texts, two recurrent themes emerge as paramount in effective construction site management practices: Health and Safety Management, and Environmental Management. These themes stand as pillars, indispensable for ensuring not only the well-being of workers and site users but also the overall success of construction endeavours.

First and foremost, prioritising Health and Safety Management is non-negotiable. The construction industry, unfortunately, remains one of the most dangerous sectors for workers. The Chartered Institute of Building (CIOB) underscores the pivotal role of ensuring workforce health and safety, advocating for a zero-tolerance stance against unsafe practices. Recognizing this, industry stakeholders must adopt stringent measures and robust protocols to safeguard every individual involved in construction activities.

Furthermore, in an era marked by escalating environmental concerns, Environmental Management emerges as an imperative facet of effective construction site management. The essential need to mitigate the environmental impact of construction operations has intensified, necessitating a paradigm shift in approach. It is no longer sufficient to merely minimize harm; instead, there's a growing obligation to proactively address environmental considerations throughout project lifecycles.

While Mohamed & Anumba (2006), Dube et al. (2015), Fryer (2004), and Griffith & Watson (2004) assert the paramount importance of ensuring the physical health and safety of workers, this paper, while in agreement with their stance, aligns with the perspective presented by Sherratt and Farrell (2022). It contends that alongside addressing physical health concerns, prioritizing the mental well-being of workers holds equal significance.

Lingard et al. (2017) shed light on concerning statistics regarding elevated suicide rates within the UK construction industry, particularly among male workers, with certain occupational groups facing heightened risks. They attribute these distressing figures to various factors, including job pressures, hazardous work conditions, and a pervasive macho culture prevailing within the industry. Additionally, irregular employment patterns and subpar working conditions exacerbate the challenges faced by workers (Sherratt, 2018) (Sherratt & Turner, 2018).

In essence, while acknowledging the necessity of ensuring physical health and safety, it is imperative to recognise and address the mental health risks faced by workers in the

construction sector. Only through comprehensive measures that encompass both physical and mental well-being can the industry truly prioritize the holistic welfare of its workforce.

Another aspect highlighted as a crucial practice in construction site management by both Mohamed & Anumba (2006) and Griffith & Watson (2004), yet overlooked by Dube et al. (2015), Fryer (2004), and Sharrett & Farrell (2022), is the significance of effective materials management onsite. This paper aligns with the former authors, asserting that proper handling of materials is essential for facilitating the smooth progress of a construction project. Given that materials constitute a significant portion of project expenses, ensuring their efficient management not only promotes cost-effectiveness but also enhances project efficiency, versatility, safety, and various other benefits essential for project success (Oldham, 2023).

Both Fryer (2004) and Sharrett & Farrell (2022) emphasize the critical role of effective communication in ensuring successful construction site practices. However, while Mohamed & Anumba (2006) and Griffith & Watson (2004) do not explicitly address this theme, this paper aligns with the viewpoint of the former authors, asserting that without a robust communication strategy, project success is unlikely. Despite the absence of direct references to communication, both Mohamed & Anumba (2006) and Griffith & Watson (2004) underscore the significance of management, supervision, administration, leadership and teamwork coordination, respectively. These elements implicitly highlight the indispensability of communication, as the effective execution of these tasks' hinges upon clear and efficient communication channels.

Effective communication serves as the foundation of success within the construction sector. Spanning from project inception to its culmination, proficient construction communication is not merely advantageous, but imperative, as it holds the potential to dictate project outcomes. Inadequate communication within construction settings can swiftly escalate, precipitating a host of complications (Construction Industry, 2024).

The argument put forth by Fryer (2004), Sharrett & Farrell (2022), and Griffith & Watson (2004) underscores the significance of site organization and management as a paramount practice in construction site management. However, this paper diverges from the perspective proposed by Mohamed & Anumba (2006) by asserting that the absence of explicit mention does not diminish the importance of this theme. Contrarily, this paper aligns with the notion that effective site organization and planning are indispensable for proficient site management.

The essence lies in the acknowledgement that meticulous planning, strategic layout, and adept management of a construction site serve as catalysts for optimal productivity. Such measures mitigate delays stemming from inadequate distribution of resources and suboptimal access or loading arrangements. Consequently, proficient site management not only amplifies productivity but also translates into considerable savings in both time and monetary resources for the project (Griffith & Watson, 2004).

In synthesizing these perspectives, it becomes apparent that effective construction site management demands a comprehensive approach that embraces various facets, including communication management, physical and mental wellbeing management, environmental management, and material management, alongside site management, which emerge as some of the foremost construction site management practices. It is crucial to acknowledge that this does not negate the existence of other pertinent criteria for effective construction site management practices. However, for the purpose of this paper, the focus will be on scrutinizing these particular criteria, derived from an assessment of diverse literature sources within the UK context.

## 2.4. Explanation of Parameters and Sub-Topics Development

### 2.4.1. Site Management

Site management involves the strategic planning, organisation, and continuous supervision of construction sites to optimize logistical operations. The primary goal is to establish an efficient site layout early in the project and implement necessary measures to ensure smooth production management. Flexibility is crucial to accommodate changes throughout the construction process, including project completion.

March (2017), Griffith & Watson (2004), and Sherratt & Farrell (2022) emphasize essential components of effective site layouts, including site boundary demarcation, access control, service provision, signage, welfare amenities, storage facilities, waste management infrastructure, designated equipment areas, and security measures (March, 2017) (Griffith & Watson, 2004) (Sherratt & Farrell, 2022). Sherratt & Farrell (2022) additionally highlight the importance of designated loading areas, emergency egress routes, and firefighting provisions, aspects not extensively addressed by other sources.

The site boundary plays a critical role in legal compliance and access rights, requiring secure demarcation and permissions to prevent trespassing. Security measures like booths, personnel, surveillance systems, and fencing ensure site integrity, even beyond working hours. Clear signage at boundaries aids in communication and safety protocols (March, 2017) (Sherratt & Farrell, 2022).

Traffic management involves planning roads, pedestrian paths, and vehicle routes within the site to enhance safety, requiring meticulous Traffic Management Plans. Access to utilities such as water, electricity, and sewage is essential and managed through existing infrastructure or contractor facilitation. Welfare facilities, including restrooms and break areas mandated by UK CDM Regulations, are centralized in welfare cabins strategically placed for accessibility (Griffith & Watson, 2004).

Site offices provide secure environments for work and document storage, tailored to project scale and workforce size. Emergency preparedness includes clear escape routes, fire safety

protocols, and strategically positioned fire extinguishers and assembly points (Griffith & Watson, 2004) (Sherratt & Farrell, 2022).

In conclusion, effective site management encompasses boundary control, security, traffic management, utilities provision, welfare facilities, site offices, storage solutions, and emergency readiness. These elements are crucial for project success, ensuring safety, productivity, and compliance with regulatory standards. A well-designed site layout enhances project perception, while disorder can lead to hazards and negative outcomes (Sherratt & Farrell, 2022).

### 2.4.2. Physical and Mental Wellbeing

The construction industry in the UK is widely acknowledged as having one of the most hazardous working environments, a consensus supported by reputable sources such as the Chartered Institute of Building (CIOB) and the UK's Health and Safety Executive (HSE). According to HSE data from 2023, the construction sector recorded 45 fatalities, ranking highest among industries in terms of workplace deaths (HSE, 2024). Key causes of these fatalities included falls from height, being struck by moving objects, and collisions with vehicles, collectively accounting for the majority of fatal injuries (HSE, 2024).

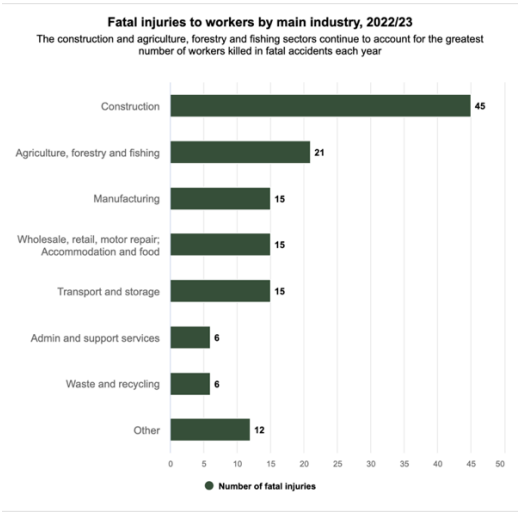


**Figure 4: Fatal injuries to workers by main industry, 2022/23**

Source: (HSE, 2024)

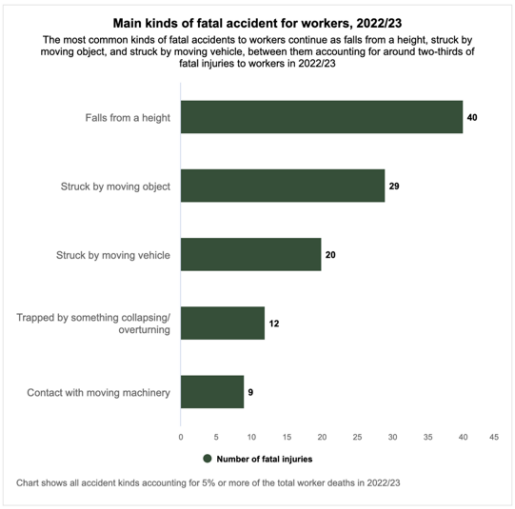


**Figure 5: Main kinds of fatal accidents for workers, 2022/23**

Source: (HSE, 2024)

Smallwood and Lingard (2009) estimate approximately 60,000 fatalities annually on construction sites globally, highlighting the comparatively safer conditions in the UK construction sector (Sherratt & Dainty, 2017). Dart (2023) underscores the industry's

commitment to safety through rigorous risk assessments and the mandatory use of personal protective equipment (PPE) like high-visibility clothing, hard hats, and gloves, as stipulated by health and safety regulations (Dart, 2023).

In contrast, construction environments in Malta present several safety challenges. According to a report by Daphne Caruana Galizia Foundation, the Occupational Health and Safety Authority (OHSA) has documented at least 49 fatalities among construction workers from 2010 to 2022. The years 2021 and 2022 were particularly tragic, with nine and ten deaths recorded, respectively. Examining these statistics over four-year intervals reveals a concerning increase in fatalities, which aligns with the surge in construction activities throughout Malta and Gozo. This trend highlights the pressing need for enhanced safety protocols to safeguard the lives of workers in the industry (Daphne Caruana Galizia Foundation, 2023).

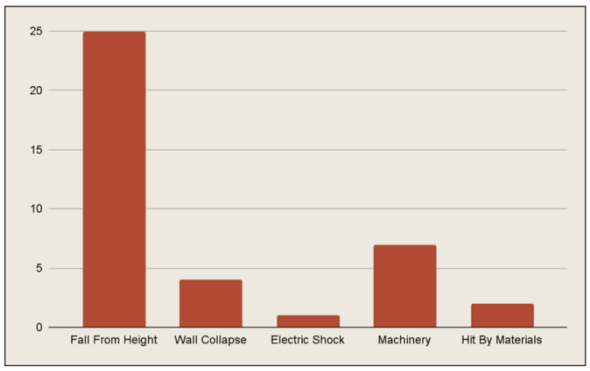


**Figure 6: Cause of construction fatalities from an analysis of 39 incidents**

Source: (Daphne Caruana Galizia Foundation, 2023)

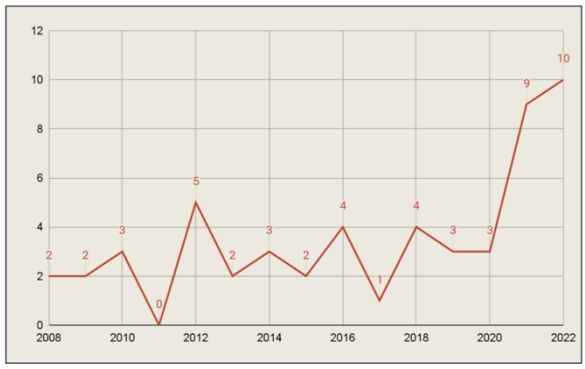


**Figure 7: Construction worker fatalities in Malta by year.**

Source: (Daphne Caruana Galizia Foundation, 2023)

The available statistics on construction site injuries come from the National Statistics Office (NSO), which relies on data from the Department of Social Security (DSS). The DSS only records non-fatal injuries when an Injury Benefit claim is made, leading to an incomplete picture. Undocumented workers and those who do not file claims are not included, nor are bystanders injured by construction activities. Nonetheless, the existing data still reveal a concerning number of accidents on construction sites as shown in figures 8 and 9 (Daphne Caruana Galizia Foundation, 2023).

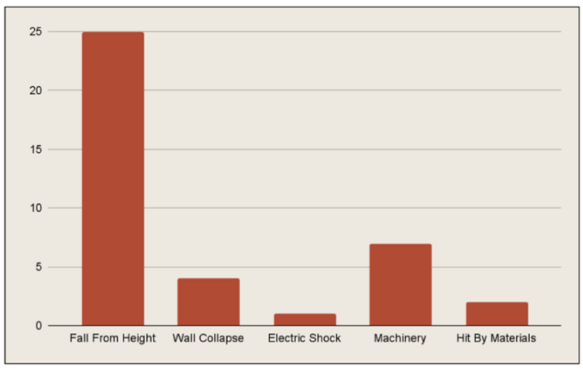


**Figure 8: Cause of construction fatalities from an analysis of 39 incidents.**

Source: (Daphne Caruana Galizia Foundation, 2023)

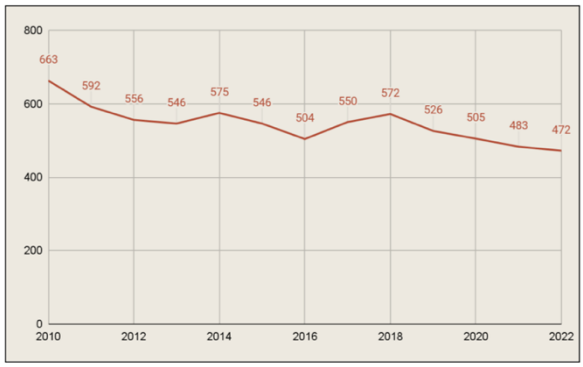


**Figure 9: Number of reported construction non-fatal injuries by year.**

Source: (Daphne Caruana Galizia Foundation, 2023)

Dart (2023) and the Chartered Institute of Building (CIOB) share a common stance on promoting safe working conditions in the physically demanding construction sector. They both stress the employer's responsibility to provide secure environments and appropriate personal protective equipment (PPE), ensuring workers are fit and competent for their tasks (CIOB, 2024). However, the CIOB uniquely emphasizes the importance of addressing workplace illness and mental health, a critical aspect not specifically highlighted by Dart. This paper supports the CIOB's perspective, advocating for the integration of comprehensive mental health support in today's construction industry. As global attention to mental health grows, it is essential for the construction sector to prioritize holistic well-being alongside physical safety (CIOB, 2024).

Lingard et al. (2017) draw attention to high suicide rates among UK construction workers, attributing this to job pressures and cultural factors that discourage seeking help. Sherratt and Turner (2018) argue for systemic changes and increased managerial responsibility in addressing these mental health challenges (Sherratt & Turner, 2018).

In conclusion, while strides have been made in physical safety within UK construction, integrating comprehensive mental health support and addressing cultural norms are essential steps toward ensuring holistic well-being and safety in the industry (Huhtala & Parzefall, 2007)(Campbell & Gunning, 2020).

### 2.4.3. Material Management

Material management involves overseeing the acquisition and utilization of materials and equipment in construction projects to meet quality and quantity requirements within specified timeframes. It constitutes a significant portion of project budgets, often exceeding 50% of total costs, highlighting its critical role in project success (Patil, 2021).

Patil, Ayegba, Donyavi, and Flanagan agree that material management encompasses planning, identification, procurement, storage, receiving, and distribution stages (Patil, 2021) (Ayegba, 2013) (Donyavi & Flanagan, 2009). Ayegba emphasizes minimizing waste and enhancing profitability through efficient cost management. The primary objective is to ensure materials are available at their point of use, selected, purchased, delivered, and handled promptly and cost-effectively (Ayegba, 2013).

Initiating with site-generated needs, material management involves transmitting information to the store department for ordering and generating indents. Vendor selection ensures cost-effectiveness, and materials undergo inspection upon arrival (Patil, 2021).

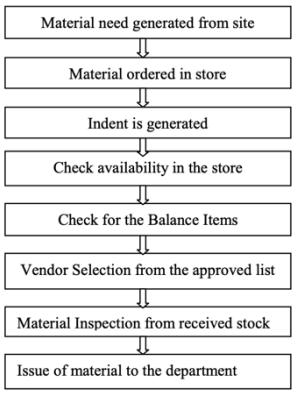


**Figure 10: Material Management Process**

Source: (Patil, 2021)

However, challenges in procurement and supply include mismatches, ordering oversights, early or delayed deliveries, lack of Just-in-Time (JIT) strategies, inadequate training, and poor communication with supply chain partners. On-site issues compound these challenges, such as delayed work due to untimely deliveries, material theft, and rework from selection errors (Donyavi & Flanagan, 2009).

Akintoye (1995) and March (2017) advocate for JIT deliveries in construction, aligning with this paper's endorsement. JIT aims to reduce inventory by supplying materials precisely when needed, lowering costs associated with procurement, storage, and obsolescence. Its implementation requires careful consideration of impacts on production planning, contractor-supplier dynamics, and the need for education and training (Akintoye, 1995) (March, 2017).

### 2.4.4. Environmental Management

Griffith and Watson highlight the mounting pressure on the construction industry to adopt environmentally friendly practices, driven by client, contractor, and regulatory demands. They stress the need for principal contractors to operate with greater environmental responsibility, recognizing the significant impacts all construction projects have on the environment. Effective environmental management involves thorough planning, organization, and

execution of site operations to identify and mitigate environmental risks, ensuring compliance with environmental laws and integrating environmental protection into project management. Environmental impacts from construction include harm to natural habitats, disruption to communities, water pollution, noise, and waste generation, much of which ends up in landfills, exacerbating environmental issues. Minimizing waste generation and promoting reuse, recycling, and safe disposal practices are essential components of effective construction project management (Griffith & Watson, 2004).

Sherratt advocates for comprehensive environmental management strategies in construction, focusing on reducing pollution sources like fumes, dust, noise, vibration, and light. Strategies include maintaining machinery, adopting electric-powered equipment, and strategically locating diesel generators away from sensitive areas to mitigate fumes. Dust control measures involve covering vehicles, enforcing speed limits, and using wash systems. Noise reduction tactics include limiting noisy activities to specific hours, positioning loud equipment away from sensitive areas, and using electric machinery. Vibration levels are monitored closely, with adjustments made to work methods as necessary. Light pollution is minimized by controlling floodlight usage to illuminate only necessary work zones during nighttime (Sherratt & Farrell, 2022).

Construction waste, a significant environmental concern, constitutes a substantial portion of annual waste production in the UK. March notes a positive shift in the industry's attitude towards waste disposal due to increased environmental awareness and landfill taxes (March, 2017). However, Sertyesilisik, Remiszewski, and Al-Khaddar's research reveals deficiencies in waste management practices across UK construction sites, citing mishandling, weather damage, theft, inadequate storage, and lack of recycling facilities as major contributors to waste generation (Sertyesilisik et al., 2012). The UK Construction Industry Annual Waste Report 2023 corroborates these findings, indicating widespread non-compliance with waste regulations and highlighting challenges in achieving high levels of reuse and minimal landfill usage (Qualis Flow Limited, 2023).

### 2.4.5. Communication Management

Effective communication is indispensable in the construction industry due to its project-based nature and the complexity of collaborations involving various stakeholders. Challenges such as technical terminology, competition, and multiple stakeholders complicate information exchange (Dainty et al., 2006). Dainty, Moore, and Murray underscore its critical importance for individuals, teams, and organizations, a sentiment echoed by Griffith and Watson who emphasize its crucial role for construction managers based on survey findings (Dainty et al., 2006) (Griffith & Watson, 2004). Establishing agreed-upon communication methods is essential to navigate industry challenges effectively at all levels, facilitating coordinated results, change management, employee motivation, and understanding workforce needs (Dainty et al., 2006).

In addition to these challenges, the presence of migrant and foreign workers in the construction industry introduces multilingual environments on sites, posing safety, integration, and productivity challenges not fully addressed by Dainty, Moore, and Murray (Fellows et al., 2023). Scholars like Philip D. Bust, Alistair G. F. Gibb, and Sarah Pink stress the urgent need to communicate health and safety protocols effectively to migrant workers who may not understand the local language, advocating for translations, interpreters, and visual aids (Bust et al., ).

Leo Aspden, contributing to Construction Management by CIOB, emphasizes another critical aspect of communication often overlooked: the importance of feedback mechanisms for project success and ongoing development (Aspden, 2022). This paper supports Aspden's perspective, highlighting the value of integrating feedback from construction workers to enhance performance at all levels. Aspden stresses that effective feedback channels should be bi-directional, encouraging managers to not only give but also receive feedback adeptly, fostering a culture where input is valued and contributes to overall performance improvement (Aspden, 2022).

## 2.5. Maltese Context

### 2.5.1. Existing Maltese Legislation Regarding Developed Criteria

The purpose of this section is not to redundantly enumerate the legal provisions readily accessible to all. Rather, it aims to delineate and provide references to the existing Maltese regulations, if any, pertaining to the developed criteria: site management, physical and mental wellbeing, material management, environmental management, and communication management.

#### 2.5.1.1. Site Management

Site Organisation & Cleanliness

S.L.623.08 – Construction Management Site Regulations provides guidelines to ensure cleanliness and environmental protection at construction sites. Key measures include containing and disposing of trash and debris in closed receptacles, preventing pollutant discharge into public areas or water systems, promptly cleaning spills, managing dust through sweeping, washing, or vacuuming, and keeping chemical areas away from sewers and waterways. Vehicle tires must be cleaned before entering public areas. Rodent control measures include preventing sewage discharge, disposing of organic waste immediately, and using traps or poison. However, the regulations lack details on the frequency and methods for cleaning tasks, do not include requirements for regular inspections or audits, and omit guidelines for proper site organization, potentially leading to inconsistent practices and accountability issues.

Signage

According to Maltese regulations, specific requirements govern the placement and maintenance of notice boards at construction sites. As per S.L.623.08 in the First Schedule, it is mandatory to install a notice board along the site boundary. This board must prominently display essential information such as details about the client, site manager, perit (supervising architect or engineer), contractor, contact number, start date of works, and the development permit number. It is crucial that this notice board remains easily readable and in good condition. Furthermore, under S.L.424.15, employers are obligated to ensure all workplace signs comply with the Workplace (Provision of Health and Safety Signs) Regulations. These regulations specify that signs indicating emergency routes and exits must be clearly marked and durable, placed at appropriate locations within the premises. Notably, while there exists no legal requirement under these regulations to display signs inside buildings indicating floor or level numbers for navigation purposes, it is recommended as a best practice.

Security Measures

S.L.623.08 in the Second Schedule mandates the client to erect barricades around excavated sites using timber, metal, bricks, or similar materials, ensuring that access is blocked to unauthorized persons. Access openings must be kept closed at all times with gates, and locked when the site is unattended, until completion of the works. Gates must be designed to prevent public access, especially by children.

Regarding S.L.424.15, the requirement for employers to prevent unauthorized access to areas with health and safety risks is commendable. However, the regulation lacks specific guidance on the types of devices or measures to be installed for this purpose. Clear guidelines on appropriate security measures would improve consistency and effectiveness in safeguarding workers and visitors from potential hazards.

Welfare Amenities

Subsidiary Legislation 424.15 outlines various workplace requirements to ensure safety and comfort, including the arrangement of workstations to prevent slipping or falling and protection from adverse weather, ergonomic seating for seated tasks, and provision of drinking water and rest facilities. It mandates changing rooms for workers wearing special clothes, clean and ventilated washing stations and sanitary conveniences, and designated smoking areas. However, the regulation lacks specific criteria for determining "substantial risk" in workstation placement, standards for adequate facilities, and clarity on penalties for non-compliance. This lack of detail may lead to inconsistent interpretations and enforcement, affecting the overall effectiveness in safeguarding worker health and safety.

Pedestrian Management

Subsidiary Legislation 623.08 prohibits obstructing pavements or traffic flow near construction sites with materials or equipment without Local Council authorization. It mandates safe passage past the site, even requiring temporary pedestrian pavements if

necessary, but lacks details on the construction and security of these passageways. Similarly, Subsidiary Legislation 424.15 requires employers to ensure that traffic routes and access points are safe and free from hazards for both pedestrians and vehicles. However, it does not specify enforcement mechanisms or penalties for non-compliance, nor does it provide standards for the construction and maintenance of traffic routes, potentially leading to inconsistent safety practices.

Fire & Emergency Preparedness

Subsidiary Legislation 424.15 mandates employers to ensure emergency preparedness and fire safety in the workplace by providing and maintaining clear, illuminated emergency routes and exits, taking measures for first aid and evacuation, preventing fire and explosion risks, and regularly maintaining fire-fighting equipment and alarm systems. Fire drills must be conducted every six months, with records kept. While these regulations aim to ensure safety, they lack specific guidelines on emergency measures, maintenance schedules, and criteria for assessing emergency routes, potentially leading to inconsistent implementation. Additionally, the absence of specified penalties for non-compliance and clear criteria for the satisfaction of responsible authorities may weaken enforcement and effectiveness.

### 2.5.1.2. Physical and Mental Wellbeing

Personal Protective Equipment

Subsidiary Legislation 424.21 establishes comprehensive guidelines on the provision and upkeep of Personal Protective Equipment (PPE) by employers, specifying the types of PPE required for different job tasks. However, it does not assign a health and safety authority to advise on PPE selection and duration, leaving these critical decisions solely in the hands of employers who may lack specialized knowledge. This gap raises concerns about potentially inadequate protection for workers. Similarly, the General Provisions for Health and Safety at Workplaces Regulations (S.L. 424.18) mandate that employers identify and communicate health and safety risks, yet they do not clarify who should conduct risk assessments, which could compromise worker safety. Despite these limitations, the regulations overall provide robust guidelines for the use of PPE, aiming to enhance workplace safety effectively.

Fall Protection

S.L.424.36, the regulations concerning fall prevention at heights, outline various measures, including the implementation of collective preventive measures, the use of appropriate equipment, and the installation of protection railings and barriers. While these provisions address key aspects of worker safety, their effectiveness is contingent upon proper implementation, maintenance, and enforcement. However, critical shortcomings include the lack of specific criteria for determining when collective measures are necessary, guidance on suitable means of access, and clarity on the construction and placement of protective barriers. Without clearer guidelines and stricter enforcement, there is a risk of inconsistent practices

and inadequate protection for workers exposed to fall hazards. Regular inspections and audits are essential to ensure compliance and identify areas for improvement in fall prevention measures.

Scaffolding Safety

Regulations S.L.424.36 and S.L.424.35, mandate that scaffolding must be designed, constructed, and maintained to prevent collapse or accidental movement, with work platforms and ladders constructed and used to prevent falls or exposure to falling objects. Scaffolding requires inspection and certification by a competent person before use, periodically thereafter, and after any modifications or prolonged disuse or exposure to adverse conditions. Mobile scaffolding must be secured against spontaneous movement. However, critical gaps exist in specific design and construction standards, inspection frequencies, and criteria for inspector competency, potentially leading to inconsistent safety standards. Additionally, there is a lack of detail on training requirements for workers, undermining overall scaffold safety.

First-aid and Medical Facilities

S.L.424.15 and S.L.424.18 outline requirements for firefighting and evacuation roles, emphasizing designated responsibilities, training, and procedures for serious danger. However, they lack specific criteria for adequate training and equipment, and guidelines for maintaining and updating registers. The regulations also don't clarify how to assess sufficiency and competence, leaving room for interpretation. S.L. 424.36 mandates first aid provisions, including personnel availability, first-aid room provision, and equipment accessibility, but lacks clarity on determining necessity and required equipment types. Clearer guidelines are needed for consistent implementation and compliance across workplaces.

Plant and Equipment

S.L.424.36 mandates requirements for excavating and materials-handling machinery, emphasizing proper design, maintenance, and operator training to prevent accidents. It stresses preventive measures to avoid machinery falling into excavations or water, and protective structures for operator safety. However, it lacks specific ergonomic design criteria and training standards, potentially leading to inconsistent implementation. Enforcement mechanisms and consequences for non-compliance are also absent. S.L.424.15 requires employers to maintain equipment and ensure safe pedestrian and vehicular traffic routes in the workplace. While it emphasizes maintenance systems and route safety, it lacks specific guidelines and enforcement mechanisms, potentially leading to safety inconsistencies. S.L.424.35 outlines employer responsibilities for work equipment safety, including suitability, maintenance, and worker training. However, it lacks clarity in defining certain terms like "adequate training" and "appropriate measures," and the requirement for worker consultation could be strengthened. Enforcement may be hindered by the burden of proving impracticability in legal proceedings. Overall, while comprehensive, refinements could enhance efficacy and enforceability.

Mental Wellbeing

Currently, there is no specific Maltese legislation addressing mental health concerns within the construction industry. While regulations and standards exist to ensure physical safety on construction sites, there's a notable gap in addressing the mental well-being of workers. Given the demanding nature of construction work, including long hours, high-pressure environments, and physical risks, mental health issues such as stress, anxiety, and depression can be prevalent. Implementing legislation or guidelines specifically tailored to promote mental health awareness, provide support services, and address work-related stressors within the construction sector is crucial for safeguarding the overall well-being of workers in Malta.

#### 2.5.1.3. Material Management

Currently, there are no specific regulations in Malta addressing material handling, material storage, inventory management, just-in-time implementations, or training and education within the context of construction activities. While general workplace health and safety regulations may apply, there's a lack of comprehensive guidelines tailored specifically to these aspects of construction operations. This absence of dedicated regulations may lead to inconsistencies in practices and potentially compromise efficiency, safety, and environmental considerations within the construction industry. Implementing regulations focused on these areas could enhance overall performance, mitigate risks, and promote better standards in construction practices in Malta.

#### 2.5.1.4. Environmental Management

Waste management

The outlined provisions of the fourth schedule of S.L.623.08 aim to ensure environmental cleanliness and public health during construction activities. Measures include containing trash on-site, avoiding discharge of pollutants into public areas or water systems, promptly cleaning up spills, and maintaining hygiene through waste removal. They also include measures how to store hazardous material on site. However, while these regulations appear comprehensive, their effectiveness relies heavily on enforcement. Challenges may arise due to inadequate monitoring or non-compliance from contractors and clients. Additionally, the burden of responsibility is placed on the client, potentially leading to conflicts or negligence in fulfilling obligations. Moreover, the reliance on self-reporting for justifying extensions in waste removal timelines raises concerns about accountability and transparency. Furthermore, no information is provided about how the construction waste should be separated. Overall, while the intentions behind these regulations are commendable, their practical implementation and oversight mechanisms warrant critical scrutiny to ensure genuine environmental protection and public safety.

Noise Management

The regulations detailed in S.L.623.08 – Fourth Schedule aim to reduce noise pollution from construction activities. They establish permissible hours for noisy operations and set noise level limits to minimize disturbance to residents. However, challenges such as loopholes in enforcement and practical implementation may hinder their effectiveness. For instance, the requirement to notify authorities promptly about unconventional work hours could cause delays or non-compliance. Moreover, exemptions under specific conditions, like emergencies or distant habitable spaces, introduce ambiguity and raise concerns about fairness and accountability. Although mandating effective exhaust systems for equipment is sensible, the regulations lack clarity on enforcement and penalties for non-compliance, potentially undermining their impact. In conclusion, while the intent to combat noise pollution is commendable, ensuring rigorous enforcement and clear implementation strategies is crucial for achieving meaningful community satisfaction.

Water Management

Currently, Maltese legislation lacks specific provisions addressing water management during construction activities. While existing environmental regulations touch upon water conservation and pollution prevention, there's a notable absence of comprehensive guidelines for managing water within construction sites. This gap poses risks of water quality degradation due to runoff, sedimentation, and contamination. Moreover, the absence of dedicated legislation overlooks the potential for utilizing rainwater efficiently. Implementing legislation or standards tailored to water management during construction would foster sustainable practices, curb environmental degradation, and protect Malta's water resources.

Air Quality Management

The regulations outlined in S.L.623.08 – First, Second, and Third Schedules aim to regulate construction activities for environmental protection and public health. They include measures like dust control, containment of building materials, and specific hoarding designs to minimize pollution and enhance safety. However, there are notable areas needing improvement. While mandating dust extraction systems for machinery is positive, standards for equipment and their effectiveness vary, leading to potential inconsistency in implementation. Requiring impermeable structures for stone and brick cutting could raise costs and logistical issues for smaller projects. Daily sidewalk cleaning mandates appear impractical and costly, questioning feasibility. Prohibiting mechanical fair facing of stones lacks alternative methods guidance, potentially limiting architectural options. Overall, while these regulations prioritize environmental and safety concerns, addressing practical challenges and ensuring consistent enforcement are crucial for effective and sustainable implementation.

#### 2.5.1.5. Communication Management

Currently, in Malta, there are no regulations specifically addressing general communication, cultural and linguistic considerations, communication documentation, or communication between project stakeholders within construction sites. Similarly, there are no direct regulations on feedback mechanisms in construction projects. However, certain provisions in S.L.424.18 hint at the importance of communication and feedback. For instance, employers are obligated to consult workers and their health and safety representatives to promote cooperation in developing preventive measures. Workers and their representatives also have the right to make representations and proposals concerning health, safety, and welfare at work, including hazard mitigation and the removal of dangers. While there are no explicit regulations, these provisions suggest an underlying framework for fostering communication and feedback mechanisms in construction operations.

### 2.5.2. Conclusion

In summary, this section introduced the concept of construction site management practices, with the UK chosen as a model due to its stringent regulatory frameworks, technological innovations, adherence to industry standards, and modern project delivery methods. By examining UK literature, the research identified key best practices in construction site management: site management, physical and mental wellbeing, material management, environmental management, and communication management. The findings highlight a correlation between the importance of proper regulation and compliance on construction sites. However, in Malta, not all identified best practices, particularly material management and communication management, are covered by existing regulations. The results suggest the need for a new perspective on site practices, emphasizing their critical role in the design and construction of future buildings in Malta.

# 3. Methodology

## 3.1. Introduction

This chapter explores the approach to the research methodology adopted, in the context of construction site practices, employing deductive reasoning to derive and test factors identified in the literature. The research begins by identifying key themes from UK best practices through a literature review, forming the basis of an audit checklist for observational data collection. This approach ensured a systematic exploration of identified themes and practices, aligning with the study's aim to understand variations in implementing best practices across construction sites. The collection and analysis of data for this stage utilised both primary and secondary data. The initial data search strategy included a scoping review of secondary data from various sources, including legal notices, books, journals, reports, articles, and websites. Electronic databases such as Google Scholar, EBSCO, PubMed, PubMed Central, Medline, Scopus, ProQuest and Web of Science were searched. Both academic and grey literature discussing site management and its awareness were examined. The above-mentioned databases were chosen due to their strength and prominence in the research arena of construction site management and practices. The keywords used were construction site management practices, gaps, audit process and recommendations. Each keyword or combination of terms was used in the above-mentioned databases and sources. Data obtained related to a timeframe spanning 10 years or the most recent data was made available.

## 3.2. Approach to theory development

Reasoning has traditionally been split into two main types: deduction and induction. Deductive reasoning starts from general premises and leads to a specific conclusion that logically follows from those premises, focusing on logical consistency. Inductive reasoning, however, moves from specific observations to broader generalizations, introducing new information not strictly contained in the initial observations. The latter expands beyond given data and is used to draw generalizations (Ketokivi & Mantere, 2010).

In the context of a study described, the research initially identifies key themes from a literature review on optimal practices in UK construction sites. These themes informed the creation of an audit checklist, used for structured data collection. Additionally, the literature review and checklist were further supported by a semi-structured interview design, aimed at deepening understanding and gaining further insights.

Given this approach, the study employs a deductive methodology. This is suitable because the research involves developing a theory based on existing knowledge (from the literature review) and then testing specific propositions derived from this theory (via the audit checklist and interviews), ensuring a rigorous exploration of the identified themes and practices (Saunders et al., 2016).

## 3.3. Methodological Approach

The text discusses various research methods used to analyse and describe study results, including qualitative, quantitative, and mixed-method approaches. Qualitative research focuses on understanding societal issues through naturalistic and interpretive approaches, using case studies, personal experiences, and narratives to explore motivations and challenges. It gathers textual data to generate new insights but is context-specific and doesn't generalize widely (Taherdoost, Hamet, 2022).

Quantitative research, on the other hand, uses numerical data to describe and explain phenomena, employing mathematical and statistical methods to quantify observations and answer specific questions about frequency or percentage (Taherdoost, Hamet, 2022).

Mixed methods research integrates qualitative and quantitative approaches to provide a comprehensive understanding of a research subject, balancing their strengths based on study needs, which is valuable in interdisciplinary research (Taherdoost, Hamet, 2022).

Saunders et al. (2016) discuss multi-method studies, a subset of multiple methods research wherein more than one quantitative or qualitative method is employed without blending them together as shown in figure 11. They emphasize the importance of combining methods to comprehensively collect, analyse, and interpret data in business and management research (Saunders et al., 2016).

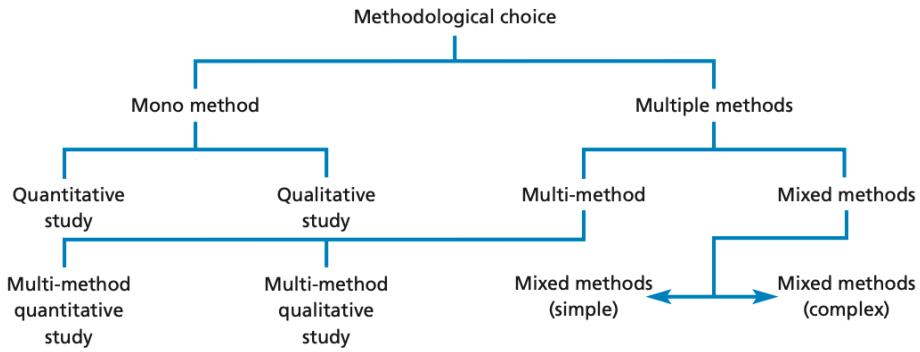


**Figure 11: Methodological Choice**

Source: (Saunders et al., 2016)

The methodological choice resulted in, an audit exercise for observational studies, a semi-structured interview, embedded with 8 case studies with the aim to explore variations in implementing best practices across sites and to understand the reasoning behind such variances. This approach constitutes a multi-method approach as opposed to a mixed-method approach.

Given the emphasis on understanding and interpretation rather than numerical representation, qualitative methods are deemed most suitable for this research. The use of both an audit checklist and semi-structured interviews constitutes a multi-method approach, enhancing the research's depth and richness by facilitating comprehensive data collection and analysis.

## 3.4. Research Strategy

Authors in the literature present eight research strategies; experiment, survey, archival and document research, case study, ethnographic, action research, and grounded theory. The research strategy adopted in this study had to be one which was ideal for investigating sensitive and multifaceted research topics, towards ensuring a detailed exploration and understanding of construction practices. It was also imperative to gain access to a number of sites to collate data for observational purposes (the audit). In this regard it was evident that a case study approach would be best suited.

The first two strategies, experiment and survey, are quantitative in nature and thus do not apply to this research given that it is mainly qualitative. Archival and document research and case study may involve quantitative or qualitative research, or a mixed design combining both. The final three strategies are principally or exclusively linked to a qualitative research design (Saunders et al., 2016).

Other strategies such as archival research involve analysing data originally gathered for non-research purposes, using methodologies like true experiments and correlational studies (Heng et al., 2018) While accessible and cost-effective, archival data may lack essential variables for rigorous analysis, often collected for documentation rather than research (Das et al., 2017) Challenges include missing data and potential biases, limiting its suitability for addressing specific research questions. Ethnography, on the other hand, immerses researchers in cultural settings through participant observation and interviews, capturing authentic practices but requiring substantial time and facing subjectivity issues (Risku et al., 2022) However, practical constraints like limited time and privacy concerns make ethnography less suitable for this study. Action Research involves collaborative problem-solving within organizations but requires a participatory approach not aligned with this research's observational focus (Saunders et al., 2019). Grounded Theory, focusing on theory development from data, demands extensive experience and rigorous analysis, posing challenges for novice researchers and thus deemed inappropriate for this dissertation (Khan, 2014).

In contrast, the case study method was considered a highly effective method for examining real-life phenomena within their natural context, offering valuable insights into complex social dynamics across disciplines like psychology, sociology, and business (Yin, 2014). It specializes in addressing "how" and "why" questions, especially when researchers lack control over the events being studied (Lavarda & Bellucci, 2022). This method was suitable to collate data collection through observations and interviews, encompassing current conditions and historical data to underpin findings (Bondin, 2022). In the context of the research questions presented in relation to construction site practices, this strategy could assist the researcher in exploring real-time activities across a diverse range of sites (Yin, 2003). The table below summarises why the case study method was considered the most appropriate method for this dissertation.

| Method | (a) Form of Research Question | (b) Requires Control Over Behavioral Events? | (c) Focuses on Contemporary Events? |
|---|---|---|---|
| Experiment | how, why? | yes | yes |
| Survey | who, what, where, how many, how much? | no | yes |
| Archival Analysis | who, what, where, how many, how much? | no | yes/no |
| History | how, why? | no | no |
| Case Study | how, why? | no | yes |

**Table 1: Relevant Situations for Different Research Methods**

Source: (Saunders et al., 2016)

Yin (2014) distinguishes between single-case and multiple-case approaches. Single-case studies offer a deep contextual understanding of a specific instance but may not capture the breadth of practices across different contexts, as needed in this dissertation. Multiple-case studies, however, involve analysing several cases to compare findings, enhancing reliability and allowing for broader generalizations (Yin, 2014).

Thus, focusing on construction site practices, the multiple-case study method was preferred given a number of sites could yield a stronger valid sample. It enabled a comprehensive analysis across various construction environments, revealing patterns and variations in practices while providing contextual insights (Saunders et al., 2016) (Yin, 2014). This approach aligned well with the research goal of understanding construction practices in diverse settings, ensuring a robust and thorough examination of the topic.

## 3.5. Case-study parameters and target population

This study examined (i) medium-scale construction projects during their (ii) ongoing project phases. These two parameters were considered mandatory for all chosen cases. Typically, medium-scale projects are larger than small residential constructions but smaller than major commercial or industrial developments, such as mid-sized residential complexes, office buildings, schools, and shopping centres. They classically occupy areas between 1,000 to 10,000 square meters and involve moderate complexity in resource management. These projects require balanced allocation of labour, materials, and equipment, encompassing trades like carpentry, plumbing, and electrical work. Compliance with regulations, site management, and safety protocols are necessary, though less extensive than on larger sites. Project durations range from several months to a few years.

The population sample used in this study included project managers primarily, with site managers as secondary alternative. The sample included project managers given they oversee all project phases from initiation to closure, ensuring adherence to time, budget, and quality

standards (Giri, 2019). As a secondary option, site managers were classified as acceptable on the basis that they are responsible for daily on-site management, ensuring safety, timeliness, budget adherence, quality control, and troubleshooting during construction (Zafari & Reza Afshar, 2021). Both roles provided insights crucial to understanding construction site practices.

## 3.6. Data Collection Techniques

Data collection is foundational in research, involving meticulous planning and execution to gather information systematically. It starts with identifying the necessary data and selecting a representative sample from the population of interest. Regardless of the field, accurate data collection is crucial for generating credible answers to research questions and testing hypotheses (Gorman & Clayton, 2004).

Data collected was obtained from 8 case studies, through observational data and semi-structured interviews. The observational studies were used to directly observe construction site practices across various sites. This method provided real-time data on how these practices are implemented and allows for a detailed examination of interactions and activities on-site. It ensures that the data collected reflects actual conditions and practices, enhancing the validity of the findings (Ebenezer, 2018). Observation methods provide direct access to phenomena, flexibility in application, and produce a permanent record for later analysis. They are especially valuable when studying phenomena in their natural setting or when there is a discrepancy between reported and observed behaviours (Lofland et al., 2005).

Following the observations, semi-structured interviews were conducted to further explore and validate the observed practices. These interviews allow participants—primarily project and site managers—to explain the rationale behind their decisions and actions, providing a context to the observed behaviours (Karatsareas, 2022). This approach not only corroborated observational findings but also uncovered underlying motivations and factors influencing construction site practices. The use of semi-structured interviews also allowed the researcher to validate or challenge preliminary observations, ensuring a more accurate and well-rounded analysis. This triangulation of data—integrating direct observations with participants' explanations—enhances the reliability of the findings (Karatsareas, 2022).

Saunders et al. (2016) highlight that while observational methods provide real-time data, they often require a detached perspective and primarily focus on the frequency and occurrence of behaviours rather than the reasons behind them. Thus, structured observation alone may only offer partial insights into on-site practices (Saunders et al., 2019). To address this, semi-structured interviews were conducted following the observational audit checklist in this dissertation. The semi-structured interviews were ideal for delving deeper into observed behaviours, providing a comprehensive understanding of how and why certain practices are implemented. This method involved following a list of themes and key questions while

allowing flexibility to adapt based on the interview's flow and context, making the data collection process more dynamic and responsive to real-time insights (Saunders et al., 2019).

The interviews enabled the researcher to introduce new questions spontaneously, enhancing the depth of the information gathered and offering richer insights into construction practices (Karatsareas, 2022). Participants could express their views and experiences in their own words, which helped in understanding the rationale behind specific practices, aligning well with the dissertation's aim to understand the motivations behind observed practices.

## 3.7. Formulating Audit Checklist and Semi-Structured Interview

The questions for both the observational checklist and the semi-structured interview were designed based on the research questions and insights from the literature review, which identified best practices for construction site management in the UK. These best practices were categorized into five themes: site organization and cleanliness, physical and mental well-being, material management, environmental management, and communication management. The literature review also assessed existing Maltese legislation, noting where it supported or lacked in these areas.

The observational checklist, which was derived from these best practices, followed a structured format (Saunders et al., 2016) and required yes or no responses, with space for additional comments for each question. It included two questions per sub-theme, based on whether checklist responses were positive or negative. This format, described by Galletta (2013), allowed flexibility for participants to introduce new insights and enabled the interviewer to adjust the sequence of questions according to the conversation's flow (Galletta, 2013). The interview concluded by asking participants for their opinion on improvements for construction site practices. This approach provided rich, multidimensional data by allowing exploration of specific study topics and accommodating new participant perspectives.

## 3.8. Data Collection Process

During the site visit, the researcher wore the necessary personal protective equipment (PPE)—safety shoes, a vest, and a helmet—and passed through the security checkpoint. Accompanied by the site manager, the researcher conducted a comprehensive tour from the basement upward, completing the checklist questions and making detailed observations without following a strict sequence. Relevant questions were filled out as specific areas were encountered. With permission from the site manager, photos were taken to aid in formulating interview questions and documenting observations, ensuring no faces were included. These photos were deleted after the visit and were not included in the dissertation publication. For aspects that were not directly observable, the researcher asked for clarification from the site manager and verified the information through direct observation whenever possible.

After the observational checklist was completed, the researcher conducted an interview in a quiet location with either the project or site manager. The participant first completed a consent form as shown in Appendix 3. Following Saunders et al.'s guidelines, the researcher introduced herself, explained the dissertation's purpose, and assured the participant of anonymity to build trust and reduce response bias (Saunders et al., 2019). Permission to record the interview was sought to enable verbatim transcription and capture both content and non-verbal cues as according to Saunders et al. (2019), it's essential to capture not just the content of the participants' responses but also their tone and non-verbal cues, which adds to the depth of understanding (Saunders et al., 2019).

Interview questions were asked flexibly, following the natural flow of the conversation. Questions were sometimes skipped if the participant addressed multiple points at once or if they were no longer relevant. Participants were encouraged to elaborate on topics, allowing for deeper insights. If the conversation deviated, the researcher gently redirected it to the structured questions. The researcher maintained a calm and respectful tone, aiming to learn from the participant rather than critique them. Each interview lasted approximately 45 minutes.

## 3.9. Data Analysis Technique and Data Preparation

Data analysis involves converting gathered data into meaningful information, and thematic analysis is a popular qualitative method for this purpose (Taherdoost, Hamed, 2020). Thematic analysis, as outlined by Braun and Clarke (2006), involves identifying recurring themes or patterns across a dataset, such as interviews or observations. This method is foundational for qualitative analysis, helping researchers discern significant ideas from thick descriptive data (Braun, Virginia & Clarke, 2006).

Thematic analysis does not prioritize the frequency of themes but rather their significance and narrative position (Prof. Rosairo, 2023). Despite debates on whether it is a standalone method or a tool within broader approaches, Braun and Clarke argue for its independent status due to its core skills applicable to various qualitative analyses. This method can be used with both deductive and inductive approaches, making it adaptable to research questions linked to existing theories or derived themes (Saunders et al., 2016).

In this study, thematic analysis commenced once data was collected from eight medium-sized construction sites. The researcher, adhering to safety protocols, observed each site, completing checklists and making detailed notes (Saunders et al., 2016)(Braun, Virginia & Clarke, 2006). The generated systematic theme analysis model is very beneficial in several fields, especially in grounded theory, ethnographic techniques, and narrative approaches. It is also amenable to descriptive, positivist-based methodology. This work improves the rigor and replicability of theme analysis and provides a thorough approach for theoretical conceptualization in qualitative research by offering a methodological roadmap (Naeem et

al., ). The process of coding (and theme generation) was characterized by flexibility and its organic nature, typically undergoing evolution during the analytical process (Braun, V. et al., 2019). As the researcher advanced through the analysis, there was an increase in the understanding of the data, which led to the discovery of new patterns of significance (Byrne, 2022).

Initial coding involved highlighting noteworthy data segments and grouping them into potential themes using colour coding. These codes were then refined into overarching themes, with further refinement to define each theme's essence and its relation to the research questions. Finally, the themes were compiled into a report, telling a coherent story of the data, aligning with Braun and Clarke's emphasis on the importance of narrative in thematic analysis (Braun, Virginia & Clarke, 2006). The observational data for each site was organized by themes, with each theme assigned to a separate page containing observations for all sites as shown in table 2. Each theme was then analysed individually. Answers were color-coded as "yes" or "no" to facilitate the identification of observational patterns across different sites. This data was valuable in providing an initial overview of the number of sites that adhered to best practices versus those that did not.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Section** | **Inspection Theme** | **Site Number** | | | | | | | |
| **A** | **Site Management** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| A.1 | Site Layout & Organization | | | | | | | | |
| 1 | Are all work areas clean and tidy? | Y | Y | N | N | Y | N | Y | N |
| 2 | Are there any piles of waste that should be removed? | N | N | Y | Y | N | Y | N | Y |
| A.2 | Signage for different zones | | | | | | | | |
| 1 | Are different work zones clearly delineated? | Y | Y | Y | N | N | N | Y | Y |
| 2 | Are there clear and visible signs indicating important information? (e.g. Emergency exits, hazard warnings?) | Y | Y | Y | N | Y | N | Y | N |
| A.3 | Security Measures | | | | | | | | |
| 1 | Are security measures in place to protect the site from unauthorized access? | Y | Y | Y | N | Y | Y | Y | N |
| 2 | Is there surveillance or monitoring to prevent theft and vandalism? | Y | Y | Y | N | Y | N | Y | N |
| A.4 | Welfare Amenities | | | | | | | | |
| 1 | Are temporary facilities well-organized and maintained? | Y | Y | N | -- | Y | N | Y | Y |
| 2 | Is there sufficient provision at breaks and lunchtimes? | Y | Y | N | -- | Y | N | Y | Y |
| A.5 | Pedestrian Management | | | | | | | | |
| 1 | Are segregating barriers secure? | -- | -- | N | N | Y | -- | Y | Y |
| 2 | Are walkways being used correctly? | -- | -- | N | Y | Y | -- | Y | Y |
| A.6 | Fire & Emergency Preparedness | | | | | | | | |
| 1 | Are fire extinguishers available and certified? | Y | Y | Y | N | Y | Y | Y | Y |
| 2 | Are emergency exits clearly marked and accessible? | Y | Y | Y | N | Y | N | Y | N |

**Legend:**
Y = Yes
N = No

**Table 2: Template for observational data analysis**

## 3.10. Ethics

Ethical considerations are crucial in all research, balancing the need for generalizable knowledge with respect for participants' privacy. Ethics involve principles that promote good and prevent harm to protect human subjects (Orb et al., 2001). In this study, which examined construction site practices in Malta, specific ethical concerns arose due to the sensitive nature of the topic.

To address these, the researcher first obtained approval from the University Research Ethics Board (UREC) for the checklist and interview questions. Following clearance, potential sites and participants were approached with a clear explanation of the study's objectives and data collection methods.

Consent was sought for recording interviews and taking photos during site visits, with recordings securely stored and erased after the study. Photos were used only to enhance observations and interviews, excluding identifiable faces to protect privacy.

Participants could choose the interview's timing and location and were informed of their right to skip any uncomfortable questions. Anonymity was maintained by referring to sites and participants with generic labels, such as Site 1 and Interviewee 1, fostering confidentiality and encouraging honest responses. The researcher’s unobtrusive presence during site visits ensured no disruption to ongoing work.

## 3.11. Validity of methods used

The dissertation aimed to analyse discrepancies between UK best practices and actual construction practices observed in Malta, alongside their alignment with Maltese legislation.

Observational data offers the advantage of real-time entry and direct verification (Saunders et al., 2019), crucial for this study due to the sensitivity of the topic in Malta, where participants may be unwilling or unable to share accurate information. However, while structured observation can indicate the frequency of occurrences, it fails to explain underlying reasons. Thus, follow-up interviews were conducted to gain deeper insights and hence support the validity of the model.

Oppenheim (1992) stresses the importance of consistent wording in attitudinal questions to ensure reliability, as changes in wording, context, or emphasis can lead to errors and biases. These issues can affect the question's meaning for different respondents and result from variations in wording, procedures, sequence, recording, and rapport. Training interviewers is crucial to mitigate these problems (Cohen et al., 2007) (Oppenheim, 1992).

In contrast, Silverman (1993) supports open-ended interviews for allowing respondents to share their perspectives and address unforeseen issues, noting that a sequence of questions suitable for one respondent may not work for another (Silverman, 1993)(Cohen et al., 2007). The semi-structured interview approach aligns with this by offering a list of themes and key

questions adaptable to the interview context. This flexibility enables omitting or reordering questions as the conversation progresses and adding questions to better explore research objectives within specific organizational settings.

## 3.12. Limitations

This study's initial limitations stem from its literature review, which uses the UK as a benchmark for best construction site practices. Although the UK may not represent the pinnacle of global practices, it is considered superior to Malta's practices and serves as a model for Malta, as highlighted in the literature review. Other nations, however, may excel in specific elements of site management. While the United Kingdom is well-known for its strict health and safety laws and organised project management, it may not be the industry leader in areas such as sustainability, innovation, or environmental management. Other EU nations, such as Germany or the Netherlands, may have more advanced methods in material management, energy efficiency, and the use of digital technologies in building. By focussing primarily on the UK, the analysis risks overlooking these superior practices, restricting the scope of comparison and perhaps missing possibilities for Malta to embrace best practices from a broader variety of nations.

Additionally, the focus on five specific areas—site organization and cleanliness, physical and mental well-being, material management, environmental management, and communication management—does not account for all possible criteria for effective construction site management. These areas were chosen based on a review of UK literature sources.

The study included only eight sites due to time constraints, attempting to select projects randomly and from various contracting companies to reflect diverse practices. However, this limited sample may not represent the full spectrum of construction projects in Malta.

During observations, potential for observer error and observer effect exists. According to Saunders et al. (2019), observer error can occur from a lack of understanding or over-familiarity with the setting, leading to unintentional misinterpretation. To mitigate this, the researcher took steps to thoroughly understand the context before making interpretations. The observer's presence might also influence the behaviour of those observed, affecting data reliability and validity. The researcher minimized interaction, avoided eye contact, and sought to blend into the background to reduce these effects, as suggested by Saunders et al. (2019) (Saunders et al., 2019). Guidance from a certified auditor was also sought to minimize bias and uphold ethical standards during observations.

# 4. Results and Discussion

## 4.1. Introduction

This chapter aims to analyse the data obtained from observations and semi-structured interviews using thematic analysis. It will present the main findings and identify emerging patterns in construction site management practices across different sites. Additionally, the chapter will address the research questions of the study by linking the observed practices with the overarching themes and insights gathered from the interviews.

## 4.2. Research Questions & Chapter Structure

The main purpose of this chapter is to address the following research questions:

1. What are the prevalent gaps in Maltese construction site practices identified when compared to the ideal construction site practices in the UK?

2. How do these variations compare with established standards and legislations currently employed in the Maltese construction industry?

3. How can the identified gaps in the implementation of construction site practices inform recommendations for improvements in both legislation and industry practices, with the aim of enhancing overall safety, efficiency, and compliance on construction sites and promoting good governance?

The chapter is organized into predefined themes from the literature review for clarity. Each theme will discuss the results from the observational checklist and interviews, relate these findings to the literature review, and answer the research questions. Recommendations for improvement will conclude each section, addressing the third research question

## 4.3. Results and Discussion

### 4.3.1. Site Management

The initial focus of the observational checklist pertains to site management. This document consolidates the findings gathered from all eight checklists and interviews conducted at each site and with respective interviewees. It offers a comprehensive analysis of site management practices across multiple construction sites in the Maltese islands. Below, the table presents a summary of the observations noted in the checklist conducted across all eight sites

| Section | Inspection Theme | Site Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A | Site Management | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| A.1 | Site Organization & Cleanliness | | | | | | | | |
| 1 | Are all work areas clean and tidy? | Y | Y | N | N | Y | N | Y | N |
| 2 | Are there any piles of waste that should be removed? | N | N | Y | Y | N | Y | N | Y |
| A.2 | Signage for different zones | | | | | | | | |
| 1 | Are different work zones clearly delineated? | Y | Y | Y | N | N | N | Y | Y |
| 2 | Are there clear and visible signs indicating important information? (e.g. Emergency exits, hazard warnings?) | Y | Y | Y | N | Y | N | Y | N |
| A.3 | Security Measures | | | | | | | | |
| 1 | Are security measures in place to protect the site from unauthorized access? | Y | Y | Y | N | Y | Y | Y | N |
| 2 | Is there surveillance or monitoring to prevent theft and vandalism? | Y | Y | Y | N | Y | N | Y | N |
| A.4 | Welfare Amenities | | | | | | | | |
| 1 | Are temporary facilities well-organized and maintained? | Y | Y | N | -- | Y | N | Y | Y |
| 2 | Is there sufficient provision at breaks and lunchtimes? | Y | Y | N | -- | Y | N | Y | Y |
| A.5 | Pedestrian Management | | | | | | | | |
| 1 | Are segregating barriers secure? | -- | -- | N | N | Y | -- | Y | Y |
| 2 | Are walkways being used correctly? | -- | -- | N | Y | Y | -- | Y | Y |
| A.6 | Fire & Emergency Preparedness | | | | | | | | |
| 1 | Are fire extinguishers available and certified? | Y | Y | Y | N | Y | Y | Y | Y |
| 2 | Are emergency exits clearly marked and accessible? | Y | Y | Y | N | Y | N | Y | N |
| A.7 | Section Comments | | | | | | | | |

**Legend:**
Y = Yes
N = No

**Table 3: Summarised Observation Results – Site Management**

Site Organisation & Cleanliness

In examining site organization and cleanliness across observed construction sites in Malta, a clear contrast emerged. Half of the sites (Sites 1, 2, 5, and 7) demonstrated exemplary standards, maintaining cleanliness and organization in line with optimal practices. Conversely, Sites 3, 4, 6, and 8 exhibited significant deficiencies, characterized by disorganization and accumulations of unmanaged waste. This disparity underscores critical gaps in construction management practices in Malta compared to the rigorous standards observed in the UK. The presence of waste piles at problematic sites reflects a failure to adhere to best practices, posing safety hazards and operational inefficiencies.

Signage for Different Zones

The evaluation of eight construction sites sharply illustrates significant disparities in signage practices, revealing both commendable adherence to safety protocols and troubling deficiencies. Five sites demonstrated thorough efforts by clearly marking work zones with essential signage, such as emergency exits, reflecting a proactive approach to safety management. However, site 8 exhibited shortcomings despite having informative signs, indicating potential gaps in implementation or maintenance. Sites 4 and 6, notably, failed to display any signage at all, raising serious concerns about safety awareness and regulatory compliance. Interviews with site managers provided insights into the rationale behind these discrepancies, ranging from assumptions of worker familiarity with the site to concerns over the practicality of frequent updates. Such justifications, however, are controversial, particularly in light of safety risks highlighted by Sherratt & Farrell (2022), which underscore the critical importance of clear emergency routes and firefighting provisions. The scholarly

perspectives of March (2017) and Griffith & Watson (2004) further underscore the indispensable role of comprehensive site layouts, including robust signage practices, in effective construction site management. This underscores the urgent need for standardized, up-to-date signage practices across all construction sites to enhance safety measures and ensure regulatory compliance, aligning with best practices advocated by safety experts in the field.

Security Measures

Across the evaluated construction sites, there was a broad range in the implementation of security measures aimed at preventing unauthorized access and safeguarding assets. Most sites exhibited proactive approaches, including perimeter hoarding, secured access gates, onsite security personnel during working hours, and 24/7 surveillance camera coverage, as confirmed through interviews. These measures reflect a strong commitment to site protection and safety, consistent with literature emphasizing access control and security in construction site management (March, 2017; Griffith & Watson, 2004; Sherratt & Farrell, 2022). Site 6 stood out for lacking surveillance systems, potentially compromising monitoring capabilities and response effectiveness. Conversely, sites 4 and 8 were identified with alarming deficiencies, relying solely on gate locking after hours, rendering them vulnerable to theft and unauthorized entry. Financial constraints emerged as a key obstacle to implementing comprehensive security measures, as highlighted in interviews with site personnel. Interviewee 8 suggested rigorous documentation and tracking of worker activities to enhance safety and accountability, aligning with safety practices advocated in construction site literature (March, 2017; Sherratt & Farrell, 2022). The absence of such systems across multiple sites underscores critical gaps in regulatory compliance and operational safety, particularly in Malta, necessitating urgent remedial actions to mitigate risks effectively.

Welfare Amenities

The provision of welfare amenities in construction varies significantly across sites, revealing both successes and failures in meeting personnel needs. Most sites reviewed met expected standards, except site 4, which lacked any amenities. This highlights a critical issue of uniformity. Of the seven equipped sites, five were well-organized and maintained, reflecting a commitment to worker well-being, as emphasized by key personnel (intervieweees 1, 2, 5 & 7). Proactive measures like replacing substandard facilities, as suggested by Interviewee 2, were noted.

Conversely, sites 3 and 6 showed inadequate organization and maintenance, potentially compromising worker comfort and safety. Reasons varied among interviewees, with Site 4's manager blaming contractors and a lack of clear guidelines. This cultural tendency in Malta, along with financial constraints (cited by Interviewee 6) and varying client attitudes (pointed out by Interviewee 3), contributes to inconsistency. The absence of regulatory frameworks exacerbates these issues, highlighted by interviewees.

Moving forward, management must emphasize welfare amenities' significance to clients and ensure legal compliance despite financial constraints. Swift compliance during inspections underscores available resources when prioritized, supporting the argument that mindset influences consistent provision and maintenance. Establishing consistent standards for welfare amenities across sites is crucial to address these discrepancies effectively.

Pedestrian Management

During the researcher's visit, it was observed that sites 1, 2, and 6 completely lacked pedestrian management systems, posing significant safety concerns regarding personnel movement. Interviewees from these sites explained that initially, designated pedestrian paths were separated from moving machinery by barriers during early civil works. However, as work progressed, these paths were removed to accommodate construction activities, and workers continued using familiar routes. The site's dynamic nature, requiring frequent changes to pedestrian paths, further complicated consistent path implementation. Conversely, sites 5, 7, and 8 demonstrated effective pedestrian management with secure barriers and properly designated walkways. Interviewees from these sites emphasized the priority of pedestrian safety, mandating the use of personal protective equipment (PPE) for visitors, who are always accompanied by knowledgeable personnel to ensure adherence to safety protocols. Notably, site 4, while using walkways correctly, had insecure barriers, highlighting a gap in safety measures. Site 3 also exhibited deficiencies with inadequate segregation security and improper walkway usage. The interviewee from site 3 acknowledged the lack of appointed personnel to oversee safety compliance, admitting that although maintaining site safety is intuitive, the absence of supervision has led to inconsistencies. This underscores the need for vigilant oversight to ensure uniform adherence to safety standards across all sites.

Fire and Emergency Preparedness

The evaluation of safety standards across multiple construction sites revealed varying levels of adherence to safety protocols. Sites 1, 2, 3, 5, and 7 were commended for their robust safety measures, including certified fire extinguishers and well-marked emergency exits. Interviews underscored a proactive approach to emergency preparedness through regular toolbox meetings and comprehensive health and safety strategies involving both clients and contractors. However, concerns were raised by Interviewee 1 regarding the adequacy of fire extinguishers, suggesting the need for additional fire safety provisions such as small fire stations on every other floor. Interviewee C emphasized the importance of frequent safety briefings, especially for new or foreign workers, aligning with the principles of continuous safety education advocated by Sherratt & Farrell (2022).

Conversely, sites 6 and 8 showed deficiencies in safety signage and emergency exit markings despite having certified extinguishers. Interviewees 6 and 8 provided justifications that revealed a reactive rather than proactive approach to safety, potentially compromising emergency preparedness. Site 4 exhibited the most severe shortcomings, lacking both fire safety equipment and accessible emergency exits, with Interviewee 4 attributing

responsibility to contractors and downplaying the site's safety needs. These discrepancies highlight critical gaps in safety planning and enforcement across sites, contrasting with established safety guidelines outlined by March (2017), Griffith & Watson (2004), and Sherratt & Farrell (2022). Addressing these issues calls for stringent safety enforcement and continuous improvement initiatives to ensure comprehensive emergency preparedness throughout all construction sites.

Theme Conclusion

The evaluation of construction site management in Malta has highlighted significant disparities in adherence to optimal standards, revealing both successes and shortcomings across various key aspects. While some sites demonstrate commendable practices such as proactive security measures and robust emergency preparedness, others struggle with basic requirements like cleanliness, signage, and welfare amenities. These deficiencies not only pose safety risks but also indicate a need for stricter regulatory frameworks and improved industry practices.

In comparison to ideal practices observed in the UK, several discrepancies are evident. Maltese sites often lack standardized practices in cleanliness, proper signage for different zones, and consistent security measures and pedestrian management. These variations underscore the necessity for comprehensive guidelines to ensure uniform compliance across all construction sites in Malta.

Moreover, the evaluation indicates discrepancies between existing legislation in Malta, such as S.L.623.08 and S.L.424.15, and their implementation. While regulations mandate aspects like site cleanliness, signage, security measures, welfare amenities, pedestrian management, and emergency preparedness, actual adherence varies widely. Some sites fail to meet these requirements due to factors like financial constraints or cultural attitudes towards safety and compliance.

The findings emphasize a need for strengthened enforcement mechanisms, clearer regulatory guidelines, and potential revisions to existing legislation. This would not only enhance compliance but also align Maltese construction site practices more closely with international best practices, thereby improving overall safety and efficiency in the industry.

### 4.3.2. Physical and Mental Wellbeing

The next theme on the observational checklist is physical and mental well-being, a topic of paramount importance. The summarized results of all eight checklists and interviews, conducted at each respective site and with each interviewee, are included here. These results provide a comprehensive overview of the physical and mental well-being across various construction sites in the Maltese islands. The table below illustrates the summarized findings from the observational checklist conducted at all eight sites.

| B | Physical & Mental Wellbeing | Site Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B.1 | Personal Protective Equipment (PPE) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Are workers wearing appropriate PPE such as safety glasses, hard hats, steel-toed boots and gloves? | Y | Y | Y | Y | Y | Y | Y | Y |
| 2 | Is there proper signage indicating mandatory PPE in specific areas? | N | Y | N | N | N | Y | Y | N |
| B.2 | Fall Protection | | | | | | | | |
| 1 | Are guardrails, safety nets, or personal fall arrest systems in place in elevated work areas? | Y | Y | Y | Y | Y | Y | Y | Y |
| 2 | Do construction workers secure themselves with safety harnesses when working at heights? | Y | Y | Y | Y | Y | N | Y | Y |
| B.3 | Scaffolding Safety | | | | | | | | |
| 1 | Is scaffolding erected according to safety regulations? | Y | Y | Y | Y | Y | Y | Y | N |
| 2 | Is scaffolding used properly by workers? | N | Y | N | N | Y | Y | Y | Y |
| B.4 | First Aid & Medical Facilities | | | | | | | | |
| 1 | Are first-aid kits available and well-stocked? | Y | Y | Y | Y | Y | Y | Y | Y |
| 2 | Is there a designated area for medical assistance, and are contacts readily available to contact first aiders in case of medical assistance? | Y | Y | Y | N | N | N | Y | N |
| B.5 | Plant & Equipment | | | | | | | | |
| 1 | Can construction plants move and operate safely? | N | Y | Y | Y | Y | Y | Y | Y |
| 2 | Is there a designated traffic management plan to ensure that pedestrians and other vehicles are safely separated from moving machinery? | N | N | N | N | Y | -- | Y | N |
| B.6 | Mental well-being | | | | | | | | |
| 1 | Is there a culture of support and fellowship among workers? | N | N | N | N | Y | N | Y | N |
| 2 | Is information about mental health support services readily available and promoted on site? | N | N | N | N | N | N | N | N |

**Legend:**
Y = Yes
N = No

**Table 4: Summarised Observation Results - Physical & Mental Wellbeing**

Personal Protective Equipment

Observational data from eight construction sites reveals a predominant adherence to personal protective equipment (PPE) among workers, though a minority fails to consistently comply with required protocols. Responsibility for ensuring compliance primarily rests with health and safety officers appointed by clients and contractors, supplemented by oversight from project managers who enforce regulations on site.

Interestingly, interviewees provided varying accounts regarding the frequency of health and safety officer visits, ranging from daily to weekly, highlighting discrepancies in oversight. One interviewee remarked on a prevalent disparity in safety culture among contractors, with some merely meeting minimal legal requirements while others demonstrate a more proactive approach. Moreover, cultural differences among workers, particularly of a specific nationality, pose significant challenges to uniform adherence to safety protocols, necessitating targeted interventions.

Regarding signage indicating mandatory PPE in designated areas, only sites 2, 6, and 7 were found to have adequate signage. Interview data underscored the importance of such signage in reinforcing compliance, especially among workers prone to disregarding PPE rules when unsupervised.

Notably, a project manager noted his limited authority in addressing non-compliance, expressing a desire for stricter penalties, potentially including dismissal, for repeat offenders. However, resource constraints and a shortage of personnel hinder the implementation of such measures effectively. This constraint raises concerns that workers may perceive leniency due to the inability to enforce stringent consequences.

Fall Protection

Observational data from eight construction sites reveals varying adherence to safety practices, consistent with broader UK construction safety trends. Most sites effectively utilized guardrails, safety nets, or fall arrest systems, and workers generally wore safety harnesses in elevated areas. However, Site 6 stood out for inadequate harness use despite having guardrails, highlighting compliance gaps. Many guardrails across sites were poorly constructed, violating regulations, and several staircases lacked proper railings, posing significant safety risks.

Sites 4, 5, 6, and 8 used steel rebars as railings without protective caps, further endangering workers. These findings align with UK Health and Safety Executive (HSE) statistics reporting 45 fatalities in 2023, primarily due to falls from elevation. Site 7 demonstrated exemplary safety measures with visible-tape guardrails and consistent harness use but experienced severe accidents, including falls due to equipment failures and inadequate covers over pile holes, resulting in permanent disabilities.

These incidents underscore the persistent risks in construction despite adherence to safety protocols. They emphasize the importance of thorough worker training and risk awareness, particularly for new employees. Interviewee insights underscored the necessity for comprehensive risk assessments and stringent safety standards to mitigate hazards effectively. Despite efforts, safety remains a critical challenge, necessitating continuous improvement in safety practices and enforcement across the industry.

Scaffolding Safety

The construction site checklist observations reveal significant disparities in scaffolding usage and safety standards across various sites. While half of the sites had scaffolding that met safety regulations upon inspection, consistent adherence to safety practices by workers was lacking. Instances at Sites 1, 3, and 4 demonstrated unsafe behaviors despite properly erected scaffolding, such as workers staying on moving scaffolds or jumping from heights instead of using them safely, indicating inadequate enforcement of safety protocols.

In contrast, Site 8 demonstrated improved commitment to safety despite initial issues with scaffold erection standards. However, workers resorted to unsafe practices like standing on rebars and wooden panels within shafts, underscoring ongoing safety concerns. Interviewees highlighted disparities between Malta and countries like Italy, where stricter enforcement and rigorous scaffolding inspections are standard practice, reflecting varying safety standards and enforcement effectiveness.

The interviews also uncovered systemic issues in Maltese construction practices, including minimal safety inspections acknowledged by all, potential conflicts of interest among inspectors, and instances of unauthorized scaffold use. These deficiencies underscore the need for enhanced monitoring and strict adherence to safety protocols to mitigate risks and

ensure worker safety. Addressing these issues is crucial to fostering a stronger safety culture among workers and aligning with best practices identified from UK literature reviews.

First-aid & Medical Facilities

The observational checklist across eight construction sites reveals a spectrum of adherence to health and safety regulations, with most sites demonstrating basic compliance rather than proactive safety measures advocated in recent literature. All sites met minimal requirements by having first-aid kits, but their quality and availability varied significantly. Site 7 stood out for strategically placed and sufficient first-aid kits, whereas site 4 exemplified minimalism with just one kit for the entire site, highlighting a compliance-focused approach over genuine safety concern.

Inconsistencies were also evident in the provision of medical assistance rooms. Only four sites had dedicated rooms, with sites 1 and 7 leading with exclusive facilities, while others like site 2 used inadequate spaces like a corner in a storekeeper's room, or repurposed their medical rooms for storage, indicating inadequate commitment to safety standards.

Training and availability of first aiders mirrored these disparities. Sites 1, 2, 5, and 7 had trained personnel, but turnover and lack of designated first-aiders at sites 3, 4, 6, and 8 compromised emergency preparedness. Site 8 notably excelled with multiple first-aiders and additional safety roles including fire marshals and an on-site nurse available three times a week, reflecting a proactive safety culture driven by dedicated client and contractor involvement, aligning with Dart's (2023) advocacy for comprehensive safety measures and the CIOB's emphasis on secure environments.

Plant & Equipment

The observational data reveals a concerning oversight in traffic management across most construction sites. Except for site 1, all sites allowed safe movement and operation of construction plants, yet only sites 5 and 7 had designated traffic management plans to separate pedestrians and vehicles from machinery. This lack of comprehensive traffic management in six sites signifies a critical gap in ensuring site safety. Without structured plans, these sites fail to adequately mitigate risks of accidents involving pedestrians and vehicles. The disparity highlights a prevalent issue: while minimal compliance with machinery operation standards is achieved, the absence of proactive traffic safety measures suggests a broader negligence in fostering a secure construction environment. This shortfall calls for urgent attention to develop and enforce robust traffic management protocols across all sites.

Mental Wellbeing

The observational study conducted on construction sites revealed a notable disparity in practices concerning mental health support. Among the eight sites observed, Site 7 stood out for its commendable approach in fostering a supportive environment. Here, workers demonstrated mutual support, aided by the contractor offering 10 free therapy sessions annually, despite no legal obligation to do so. In stark contrast, the other sites showed

deficiencies in promoting mental health services. Workers often faced isolation stemming from language barriers and occasional conflicts.

Interviewees 2 and 3 emphasized the crucial importance of addressing mental health. Interviewee 3 underscored that "it's crucial to recognize that mental health is just as important as physical health, if not more," highlighting concerns about current gaps in legislation and industry practices. Despite individual efforts from project managers such as interviewees 2, 3, 4, 5, and 6 to listen to workers' concerns, formal mental health support measures were largely absent. This situation underscores a systemic neglect of mental well-being within the construction sector, jeopardizing both worker welfare and productivity.

These findings contrast with those in the literature review, which stress the necessity of integrating mental health support in construction sites, particularly in an industry culture often dominated by a "macho-man" mentality. Looking ahead, there is a clear imperative for comprehensive policies that embed mental health support into site management, fostering a supportive workplace culture and enhancing overall employee well-being.

Training and Education

When the interviewees were asked if training programs are provided to workers regarding safety practices and the proper use of equipment, the majority of interviewees acknowledged the existence of toolbox meetings where workers receive updates on site procedures, health and safety guidelines, and equipment protocols. However, the frequency of these meetings varied greatly, from daily to yearly, depending on the contractor's discretion, despite being mandated by the Health and Safety Authority according to Interviewee 1. This variability suggests a loophole in compliance and underscores inconsistent adherence to safety standards.

Conversely, Interviewees 3 and 8 highlighted instances where toolbox meetings were absent, where interviewee 3 attributing this omission to “negligence” and the contractor seeing it as “a waste of money and time negligence and a perception among contractors that such measures are a waste of money and time”. This reflects a broader industry attitude where worker safety is viewed as an additional expense rather than a fundamental necessity, contrary to established best practices observed in the UK.

Theme Conclusion

The evaluation of Maltese construction sites reveals significant deficiencies in safety and well-being standards. Although most sites meet basic personal protective equipment (PPE) requirements, there are still gaps in enforcement and cultural challenges. Moreover, while fall protection measures often comply with regulations, they are frequently undermined by poor guardrails and unsafe practices. Additionally, scaffolding safety is inconsistent, with notable lapses in worker behaviour and minimal inspections. Furthermore, first-aid provisions vary widely, with some sites barely meeting standards while others take proactive measures. Similarly, traffic management is generally inadequate, lacking comprehensive accident

prevention plans. Mental well-being support is scarce, with only one site offering therapy sessions, thus highlighting a dire need for better mental health integration. Finally, safety training is inconsistent, reflecting an industry tendency to treat safety as a secondary concern. Consequently, these issues underscore the urgent need for stronger regulatory frameworks and a more robust safety culture within the Maltese construction industry to better meet the best practices derived in the literature from the UK.

Based on the research findings and the existing regulatory framework in Malta, several critical comparisons reveal the state of implementation and areas needing improvement across construction safety practices. While regulations such as S.L. 424.21 outline responsibilities for Personal Protective Equipment (PPE), the research highlights inconsistent adherence and oversight issues, indicating gaps in enforcement. Similarly, regulations concerning Fall Protection and Scaffolding Safety exist but lack specific criteria for certain safety measures, contributing to varied implementation and maintenance practices observed in construction sites. Furthermore, regulations mandating First-aid & Medical Facilities are in place (S.L. 424.15 and S.L. 424.18), yet deficiencies in training, equipment standards, and provision of first aiders suggest a need for clearer guidelines and stricter enforcement. These findings underscore the importance of enhancing regulatory oversight, clarifying standards, and improving enforcement mechanisms to ensure consistent adherence to safety practices and mitigate risks effectively across the construction industry in Malta. Addressing these issues is crucial to fostering a safer working environment and protecting the well-being of workers in construction sites.

### 4.3.3. Material Management

The subsequent focus of the observational checklist is on material management. This summary compiles the results from eight checklists and interviews carried out at each site and with each participant. These findings offer a thorough overview of material management practices across various construction sites in the Maltese Islands. The accompanying table displays the consolidated results from the observational checklists conducted at all eight sites

| C | Material Management | Site Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C.1 | Material Handling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Are materials transported using appropriate equipment? | Y | Y | Y | Y | Y | Y | Y | Y |
| 2 | Are materials stacked or stored in a way that minimizes the risk of collapse or falling? | N | Y | N | N | Y | N | Y | N |
| C.2 | Material storage | | | | | | | | |
| 1 | Is there proper organization and segregation of construction materials? | N | Y | Y | N | Y | N | Y | N |
| 2 | Are there designated storage areas for different types of materials? | N | N | N | N | Y | N | Y | N |
| C.3 | Inventory Management | | | | | | | | |
| 1 | Are materials tagged or labelled with essential information, such as quantity, type, and date received? | N | Y | Y | Y | N | N | N | Y |
| 2 | Is there a system in place to track material inventory levels? | N | Y | Y | N | Y | N | Y | N |
| C.4 | Just-In-Time (JIT) Implementations | | | | | | | | |
| 1 | Is the concept of Just-in-Time (JIT) deliveries implemented at the construction site? | N | Y | N | N | Y | Y | Y | N |

**Legend:**
Y = Yes
N = No

**Table 5: Summarised Observational Results - Material Management**

Material Handling

The observations across all eight sites highlight varying degrees of effectiveness in material transportation and storage practices. While all sites used appropriate equipment for transport, only sites 2, 5, and 7 demonstrated proper stacking and storage methods that minimize risks like collapse. In contrast, the other sites fell short of these safety standards, indicating a critical area needing improvement in material handling.

Interview responses revealed a notable disparity in perceptions regarding material handling capabilities. Interviewees 5, 6, and 8 expressed satisfactions with their team's practices, whereas others revealed widespread deficiencies in material handling practices, prompting urgent calls for reform. Issues include misuse of machinery due to inadequate training and tool management, failures in safety protocols like neglecting protective measures, and disparities in worker skills, particularly among foreign labour, aligning with concerns raised in the literature regarding workforce training and safety protocols (Patil, 2021) (Donyavi & Flanagan, 2009). There's also a cultural issue of worker accountability towards company-provided materials. These findings collectively underscore the need for comprehensive training, stricter enforcement of safety standards, and improved oversight to mitigate risks and enhance efficiency in construction operations.

Material Storage

The observational findings across multiple construction sites highlight substantial deficiencies in material storage practices. Only sites 2, 3, 5, and 7 were noted for their organized material segregation and effective stacking methods that mitigate risks such as collapse. Conversely, Interviewees 1, 4, 6, and 8 acknowledged lacking clear criteria for determining storage locations, leading to random placement of materials wherever space permits without

disrupting ongoing work. This reactive approach underscores a widespread issue in planning and management underscored by Donyavi & Flanagan, (2009) in the literature review.

In contrast, sites with commendable storage practices prioritize secure, long-term storage solutions such as locked indoor spaces, aligning with recommendations to prevent damage, theft, and deterioration. Despite reported progress in improving storage organization, discrepancies persist among subcontractors, indicating gaps in knowledge dissemination and consistency in implementing storage protocols. Interviewee 3's insights underscore initial challenges stemming from disorganization and highlight the ongoing need for comprehensive understanding and enforcement of proper storage procedures, particularly for perishable materials; a concept which still seems lacking on Maltese construction sites.

Inventory Management

The observational study of eight construction sites revealed a mixed landscape of inventory management practices. Half of the sites implemented basic measures like material tagging and inventory tracking systems, with sites 2 and 3 excelling by combining both effectively. In contrast, sites 1 and 6 lacked these essential controls, indicating inadequate management of inventory. Even where materials were labelled, the effort was often minimal due to the sheer volume, according to interviewee 7.

Most sites relied on locking storage areas and assigning storekeepers to monitor inventory, but interviewee 3 highlighted issues with disorganization despite these measures. This inconsistency suggests a general lack of understanding among workers regarding the importance of robust inventory management, except for a few advocates like interviewee 3 who emphasized that "The significance of proper inventory management cannot be overstated."

Sites without formal inventory systems often relied on contractors for material procurement, fostering a reactive rather than proactive approach, which experts argue leads to inefficiencies. Overall, the study underscores the critical need for a cultural shift towards prioritizing comprehensive inventory management in construction. Without such changes, the industry risks perpetuating inefficiencies and missing out on potential long-term savings and operational improvements as emphasized by Donyavi & Flanagan, (2009) in the literature review.

Just in Time Implementations

The implementation of Just-In-Time (JIT) strategies in construction projects presents a dual-sided picture based on observational data. Among the construction sites studied, half of the sites, specifically sites 2, 5, 6, and 7, embraced JIT practices. Their rationale centred on optimizing storage space and minimizing material handling risks, where all the interviewees of the latter sites, citing these as primary benefits. However, the other half of project managers expressed reluctance towards JIT adoption. Their concerns primarily centred

around the inherent unpredictability of construction schedules, which complicates precise material delivery timing—an essential aspect of JIT.

Interviews revealed further complexities. Delays in overseas shipments and the arrival of defective materials were noted as significant risks, capable of causing project delays and financial losses, expressed by both interviewees 3 and 7. The perishable nature of some materials added another layer of challenge, with suppliers preferring on-demand delivery, thereby placing responsibility on project managers to manage perishability effectively.

While Akintoye, (1995) and March, (2017) have highlighted potential efficiency gains of JIT in construction management expressed in the literature review, the observed drawbacks underscore the necessity for careful evaluation before widespread adoption. The discussions on JIT's benefits in the literature review neglected these practical complexities, suggesting a gap between theory and application. Ultimately, while JIT offers promising advantages in specific contexts, its successful implementation in construction requires addressing logistical challenges and aligning delivery schedules with project dynamics more effectively.

Theme Conclusion

The evaluation of material management practices in Maltese construction sites reveals a diverse landscape with significant room for improvement. Observations across eight sites highlight varying degrees of effectiveness in material handling, with some sites demonstrating proper equipment use and safety protocols while others exhibit deficiencies such as inadequate training and inconsistent practices. These findings show a gap from best practices derived in the literature review from the UK.

Material storage practices also vary widely, with organized methods seen in only a few sites, contrasting with haphazard approaches elsewhere that disrupt workflow efficiency. Inventory management shows a mixed picture, with some sites implementing basic controls while others lack formal systems, indicating a need for improved organizational standards and cultural shifts towards prioritizing comprehensive inventory control. Just-In-Time (JIT) strategies, though beneficial in optimizing storage and reducing risks at some sites, face challenges including unpredictable construction schedules and logistical complexities.

Overall, the findings underscore the necessity for enhanced training, stricter safety enforcement, and improved management practices to standardize and enhance material handling across Maltese construction sites. These observations also highlight that the current practices in Malta are lacking when compared to the best practices identified in the literature review from the UK.

In Malta, the regulatory framework concerning material management in construction lacks specificity, as highlighted in the literature review. The absence of dedicated regulations addressing crucial aspects such as material handling, storage practices, and inventory management, contributes to varied and often suboptimal practices across construction sites. Research reveals significant disparities in safety protocols, training adequacy, and

organizational standards among sites, indicating a pressing need for standardized guidelines. These regulations would not only enhance operational efficiency and safety but also promote sustainability by addressing issues like waste reduction and resource optimization. The findings underscore the importance of regulatory intervention to ensure consistent practices, mitigate risks associated with material management, and align construction operations with modern standards and environmental goals in Malta.

### 4.3.4. Environmental Management

The next area of attention in the observational checklist pertains to environmental management. This summary presents the outcomes from eight checklists and interviews conducted at each location and with each participant. These results provide a comprehensive review of environmental management practices at different construction sites throughout the Maltese Islands. The accompanying table shows the combined results from the observational checklists completed at all eight sites

| D | Environmental Management | Site Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D.1 | Waste Management | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Is there a system in place for sorting and recycling construction waste? | N | Y | Y | Y | Y | Y | Y | Y |
| 2 | Is there a plan for the safe disposal of hazardous construction materials? | N | Y | N | N | N | N | Y | N |
| D.2 | Noise Management | | | | | | | | |
| 1 | Are noise levels monitored at several locations across the site? | N | N | N | N | N | N | Y | N |
| 2 | Are there designated areas for noisy activities to minimize disturbance to surrounding areas? | N | N | N | N | N | N | N | N |
| D.3 | Water Management | | | | | | | | |
| 1 | Are there any observable initiatives to capture and reuse water from processes or rainwater runoff? | Y | Y | N | N | N | N | N | N |
| 2 | Are there measures in place to prevent runoff of pollutants into the streets during rain events? | N | Y | N | N | N | N | Y | Y |
| D.4 | Air Quality Management | | | | | | | | |
| 1 | Are measures in place to control dust and airborne pollutants? | Y | Y | Y | N | N | N | Y | N |
| 2 | Is construction equipment properly maintained to reduce emissions and dust spread? | Y | Y | N | Y | Y | Y | Y | N |

**Legend:**
Y = Yes
N = No

**Table 6: Summarised Observational Results - Environmental Management**

<u>Waste Management</u>

The observational data reveal that, aside from Site 1, all sites have systems for sorting and recycling construction waste, aligning with Griffith and Watson's (2004) best practices. However, challenges remain, as Interviewees 2, 3, 7, and 8 note that unsupervised workers often neglect these duties. Contractors are motivated to separate waste mainly to cut costs associated with mixed waste disposal, rather than environmental concerns. Interviewee 2 highlights that “the main challenge lies in cultural and mindset differences”, particularly among foreign workers unfamiliar with waste separation, complicating implementation.

Interviewee 8 notes that the contractor on site 8 outsourced waste separation due to high daily waste volumes, suggesting operational shortcomings.

Only Sites 2 and 7 have plans for hazardous material disposal, using dedicated,fenced off spaces, having sand on the floor o absorb any spillages while other sites either lack hazardous waste or improperly mix it with regular waste. This disparity underscores inconsistent practices in managing hazardous materials.

Interviewee 1's comment that she is “not aware of any legislation that binds us to separate construction waste and we are never penalised for such actions “ exposes a significant regulatory gap. This lack of regulatory enforcement and supervision by Maltese authorities undermines efforts to ensure consistent and effective waste management practices across construction sites.

Noise Management

The observational data on noise management reveal a significant oversight across the sites: none, except Site 7, had systems for monitoring noise levels or designated areas for noisy activities, contrary to best practices outlined by Sherratt and Farrell (2022). Site 7 had noise monitors but still lacked dedicated zones for noisy operations.

When interviewed, site representatives uniformly indicated that there was no legal requirement for noise monitoring during the researcher's visit. Their approach to noise management was limited to adhering to permitted working hours, reflecting minimal compliance rather than proactive noise control. Interviewees 3 and 8 did note that noise measuring instruments were used during the initial excavation phase due to legal requirements but were not maintained throughout the project.

Some justified the lack of noise control measures by citing their distance from residential areas, arguing it was unnecessary. However, this rationale is insufficient as noise can still affect wildlife, ecosystems, and visitors. The overall lack of consistent and comprehensive noise management practices across these sites indicates a critical gap in addressing environmental and community noise concerns, highlighting a need for more robust regulations and enforcement.

Water Management

The observational data indicates a pervasive lack of comprehensive water management across the eight evaluated construction sites. Only two sites implemented rainwater capture and reuse, primarily for construction activities and toilet flushing. These initiatives were rudimentary, involving simple storage reservoirs. Furthermore, only three sites had measures to curb pollutant runoff during rain, typically redirecting the water onsite for later disposal. Notably, only Site 2 integrated both rainwater harvesting and runoff pollution control measures, demonstrating a more holistic approach. The remaining sites exhibited a concerning neglect, neither capturing rainwater nor preventing polluted runoff, reflecting a significant oversight in environmental responsibility and sustainable practice. This limited

adoption of water management strategies underscores a broader issue of insufficient regulatory enforcement or industry awareness, necessitating urgent reforms to foster sustainable water use and environmental protection on construction sites.

Air Quality Management

The findings from observations of multiple construction sites reveal significant disparities in environmental management practices. Sites 1, 2, and 7 stand out for their thorough measures aimed at controlling dust and airborne pollutants. They employ well-maintained construction equipment designed to minimize emissions and dust dispersion. In contrast, other sites generally lack adequate dust control measures, except for site 3, which, though implementing some measures, uses equipment that is less effective in reducing emissions.

Interviews with personnel from sites 1, 2, 7, and 3 highlight common practices such as using green screening around site perimeters, acknowledged as a basic measure. Site 7 notably uses rubber screening for its durability and enhanced dust-trapping capabilities, particularly beneficial in residential areas. This measure also serves purposes beyond aesthetics, such as theft deterrence and minimizing visual disruption.

Moreover, sites with well-maintained equipment described additional measures aligned with industry best practices as described by Sherrat and Farrell (2022) in the literature review. These include equipping power tools with vacuum pumps to reduce dust, using misters during excavations to suppress airborne particles, and employing water to mitigate dust from saws and coring equipment. Effective practices like enclosing brick-cutting machines and washing truck wheels before leaving sites to prevent street contamination are also highlighted.

Regulatory compliance is emphasized, such as periodic street cleaning to remove residual dust expressed by interviewees 5 and 7 and directing exhaust pipes of concrete pump trucks away from neighboring buildings to prevent soiling walls, as expressed by interviewee 7. Despite logistical challenges, these actions demonstrate a commitment to environmental integrity.

In conclusion, while sites 1, 2, and 7 demonstrate commendable efforts in environmental management, disparities persist among other sites regarding comprehensive dust control measures and equipment emissions management. Addressing these disparities is crucial for promoting sustainable construction practices and reducing environmental impact across all construction sites.

Theme Conclusion

The observational checklist and interviews conducted across eight construction sites in the Maltese Islands provide a comprehensive review of environmental management practices, revealing both commendable efforts and significant deficiencies. Waste management practices, though implemented to varying degrees across sites, often prioritize cost savings over environmental concerns, diverging from best practices outlined in literature reviews based on UK standards. Issues such as inconsistent waste sorting due to worker negligence and cultural barriers were highlighted, compounded by a lack of regulatory enforcement as

noted by interviewees. Similarly, noise management practices fell short of recommended standards, with most sites lacking noise monitoring systems and designated noisy activity zones, contrary to best practices outlined in the literature. Water management showed limited adoption of rainwater harvesting and pollution runoff controls, reflecting a broader disregard for sustainable water use practices. Disparities in air quality management were also evident, with some sites employing effective dust suppression and emissions control measures while others did not align with industry best practices derived from UK standards. These findings underscore the urgent need for enhanced regulatory oversight, industry education, and enforcement to align construction practices in Malta with international environmental standards and ensure sustainable development across all construction sites.

Upon comparing the regulations outlined in Malta's S.L.623.08 regarding environmental management with the findings from research on construction site practices, several key observations emerge. While the regulations mandate practices such as containing trash on-site, avoiding pollution discharge, and specifying noise and dust control measures, their implementation across construction sites appears inconsistent. For instance, while some sites demonstrate efforts in waste separation and hazardous material disposal, many struggle with unsupervised workers neglecting these duties and operational challenges like outsourcing waste management. Moreover, deficiencies in noise management, such as the lack of monitoring systems and designated noisy activity zones, indicate gaps between regulatory intent and practical application. Similarly, water management lacks specific legislative provisions, leading to inadequate adoption of rainwater harvesting and runoff control measures. Concerns also arise regarding air quality management, where varying dust control practices and equipment emissions highlight the need for clearer standards and enforcement mechanisms. Overall, while Malta's regulations outline comprehensive environmental protection measures, ensuring their effective enforcement and addressing specific gaps through tailored legislation are essential for promoting consistent and sustainable construction practices across the islands.

### 4.3.5. Communication Management

The final theme in the observational checklist focuses on communication management. This section summarizes the findings from eight checklists and interviews conducted at each site and with each participant. These findings offer a thorough review of communication management practices across various construction sites in the Maltese Islands. The accompanying figure illustrates the aggregated results from the observational checklists completed at all eight locations.

| E | Communication Management | Site Number | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| E.1 | General Communication | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Are there reliable communication tools and infrastructure, such as radios or mobile devices? | Y | Y | Y | Y | Y | Y | Y | Y |
| 2 | Are visual aids employed to convey essential messages effectively to workers? | Y | Y | Y | N | N | N | Y | N |
| E.2 | Cultural and Linguistic Consideration | | | | | | | | |
| 1 | Are visible communication materials translated for diverse language groups on the site? | N | Y | N | N | N | N | Y | N |
| 2 | Are there visible signs of language barriers impacting communication among workers? | Y | Y | Y | Y | N | Y | Y | Y |
| E.3 | Communication Documentation | | | | | | | | |
| 1 | N. A | | | | | | | | |
| 2 | N. A | | | | | | | | |
| E.4 | Feedback Mechanism | | | | | | | | |
| 1 | N. A | | | | | | | | |
| 2 | N. A | | | | | | | | |

**Legend:**
Y = Yes
N = No

**Table 7: Summarised Observation Results - Communication Management**

General Communication

The data indicates that all eight sites effectively used private mobile phones as reliable communication tools for workers, highlighting the importance of direct contact in managing on-site operations. However, only half of the sites implemented visual aids to convey essential messages. This lack of visual communication at some locations poses a significant drawback. Visual aids, such as signs or diagrams, are crucial for ensuring clear and immediate understanding of critical information, especially in noisy environments or where language differences may impede verbal communication. The disparity in the adoption of visual aids points to a gap in the overall communication strategy, potentially affecting worker comprehension and safety. While the use of mobile phones supports efficient and immediate communication, the insufficient use of visual aids at several sites reveals a need for more comprehensive communication methods to ensure all workers can access and understand important information effectively.

Cultural and Linguistic Consideration

The observational data starkly highlights significant language barriers affecting communication across most work sites, except for site 5. This aligns with Fellows et al. (2023), who also identified language barriers as a major issue in the UK construction industry. Contrarily, despite the diverse linguistic backgrounds of foreign workers, only two out of eight sites had translated communication materials, contradicting best practices suggested by Bust et al. This oversight reveals a critical gap in accommodating multilingual environments effectively. Interviewees universally acknowledged the severity of language barriers, particularly with the influx of foreign labour. They predominantly favour Maltese or English-speaking workers, resorting to interpreters only when necessary. Typically, these interpreters are coworkers who understand English or Maltese, and they always work alongside those who

do not, to avoid exacerbating communication issues. Interviewee 5 accurately described language barriers as a "Silent Killer," emphasizing that unresolved communication gaps can lead to significant operational problems and even safety risks. This critique underscores the urgent need for systematic multilingual communication strategies to mitigate potential hazards and inefficiencies on construction sites.

Communication Documentation

The research findings relied solely on interviews due to the nature of the topic, which isn't observable. When questioned about their methods for effectively documenting communication within construction projects, responses varied significantly among the eight interviewees. Three interviewees highlighted the use of an online portal that integrates all project documentation, including contractor submissions, approvals, health and safety records, and construction drawings. This centralized system, accessible to all stakeholders in real-time, ensures information remains current and eliminates the risk of data being scattered across emails or WhatsApp chats, which are deemed less efficient. In contrast, the remaining five interviewees primarily relied on emails and WhatsApp for documentation, methods criticized by the researcher for their potential to overlook critical updates or messages amidst technological advancements. Interviewee 3 supplemented these methods with site reports but acknowledged their limitations in causing delays, particularly concerning safety issues. This interviewee advocated for proactive onsite supervision to address problems promptly, emphasizing real-time documentation to prevent risks and enhance accountability.

Moreover, interviewee 6 proposed a structured system for managing site instructions with cost and time implications, advocating for its effectiveness despite limited adoption. However, the researcher favoured the comprehensive and accessible nature of the online portal endorsed by interviewees 1, 2, and 5, citing its automatic updates and broad stakeholder access as superior in minimizing errors and facilitating efficient communication. Importantly, nearly all interviewees cited instances where clear documentation resolved conflicts or mitigated risks, underscoring the critical role of effective communication documentation in construction project management.

Feedback Mechanism

The feedback mechanisms explored in the interviews revealed varying approaches among site managers regarding the integration of worker feedback into construction projects. While the majority of interviewees acknowledged the value of soliciting feedback from workers due to their hands-on experience and potential for innovative solutions, interviewee 6 stood out for a more sceptical approach. Citing language barriers and a preference for centralized instruction, this manager expressed reluctance in actively seeking input from workers unless they were proficient in Maltese or trusted for their expertise. In contrast, interviewees 1, 2, 7, and 8 emphasized fostering a culture where all workers' feedback is valued and actively sought. At site 2, an intriguing practice was observed that differed from all other sites. In the basement, a notice board featured forms for workers to provide feedback or suggestions, with

a designated box for anonymous submissions if they prefer. This initiative stands out as exemplary and was not found elsewhere, aligning with the best practices advocated by Aspden (2022) as discussed in the literature review. This simple system fosters a culture of listening to and valuing worker feedback, thereby ensuring that workers feel heard and respected. Such initiatives highlight the significance of inclusive feedback mechanisms in enhancing project outcomes and worker satisfaction. They stand in contrast to centralized and hierarchical approaches that have the potential to unintentionally suppress innovation and morale within construction teams.

Theme Conclusion

The Communication Management findings underscore critical discrepancies with best practices derived from UK standards, particularly concerning language barriers. While all sites effectively use mobile phones for direct communication, only half employ essential visual aids, which are crucial in noisy or multilingual settings—an oversight contradicting recommended practices. Significant language barriers persist across most sites, exacerbated by inadequate provision of translated materials, a stark contrast to UK standards advocating comprehensive multilingual communication strategies. Documentation methods vary, with centralized online portals preferred for their efficiency and accountability, yet some sites still rely on less effective email and messaging platforms. The study highlights that these practices hinder effective communication, jeopardizing both operational efficiency and safety, as noted in the literature. Moreover, varying approaches to feedback mechanisms reveal inconsistencies in fostering inclusive practices, despite evidence suggesting their benefits for worker satisfaction and project outcomes. Overall, aligning with established best practices is crucial to mitigate the pervasive issue of language barriers and improve overall construction site communication.

The comparison between existing regulations and the observed practices in Maltese construction sites reveals both alignment and significant gaps. While regulations such as S.L.424.18 emphasize consultation between employers and workers for safety measures, they do not explicitly mandate the use of visual aids for communication. The results show that while mobile phones are widely used for direct communication, visual aids like signs and diagrams are inconsistently implemented across sites, potentially hindering clear communication in noisy environments or among workers with language barriers. Regarding cultural and linguistic considerations, there are no specific regulations requiring translated communication materials, despite evident language barriers impacting communication effectiveness on most sites. Moreover, while some sites employ advanced online portals for real-time documentation, others rely on less efficient methods like emails and messaging apps, suggesting a lack of standardized practices in documentation. Similarly, while feedback mechanisms vary, with some sites actively soliciting worker input through formalized channels like feedback forms, others rely on more centralized decision-making. Overall, there appears to be a need for clearer and more comprehensive regulations that address these gaps, ensuring standardized practices in visual communication, cultural sensitivity, documentation

methods, and feedback mechanisms to enhance overall safety, efficiency, and communication effectiveness in Maltese construction operations.

### 4.3.6. Generic Interviewee Opinion

The final question in the interview was open-ended, allowing the interviewees to freely express their thoughts on construction site practices that they believe need improvement for the overall success of a construction project. Interestingly, all the interviewees exhibited a strong interest and articulated issues that have troubled them for years. They expressed a belief that serious attention must be directed towards these issues to ensure the project's success as a whole. They were eager to respond to this question as they have long felt these concerns but lacked a suitable platform to voice them. With this opportunity, they hope their concerns can be acknowledged and addressed.

The interviews with eight construction industry professionals revealed a consensus on several key areas needing improvement to enhance the success and safety of construction projects. One recurring theme across multiple interviews was the necessity for stricter enforcement of health and safety protocols. Interviewees highlighted concerns over inadequate personal protective equipment (PPE) compliance among workers, especially foreign labourers, and called for more rigorous site inspections to ensure adherence to safety standards. There was a shared belief that better management and oversight are crucial for mitigating risks and improving overall safety outcomes on construction sites of varying sizes.

In addition to safety concerns, there was a strong emphasis on improving worker competency through standardized training and certification programs. Several interviewees expressed frustration over the variability in worker skills and the impact this has on project efficiency and safety. Language barriers emerged as a significant issue contributing to misunderstandings and safety hazards, prompting calls for mandatory language and cultural training for foreign workers before they begin on-site duties. This approach, interviewees argued, could reduce errors, enhance communication, and foster a safer working environment.

Regulatory oversight was another critical area of discussion, particularly concerning smaller construction projects. Interviewees pointed out gaps in current regulations and enforcement, advocating for stricter penalties for non-compliance and more frequent inspections. They stressed the need for regulations that are tailored to the scale of each project and ensure consistent adherence to safety standards across the board. This regulatory framework, they argued, is essential for promoting accountability and improving overall industry standards.

Beyond regulatory and safety concerns, interviewees highlighted challenges in project management and quality assurance. They emphasized the importance of disciplined work practices and effective execution of construction tasks to minimize defects and ensure project success. There were calls for greater involvement of project management teams in overseeing

not only construction progress but also health and safety practices and site cleanliness. This integrated approach, interviewees believed, would lead to better coordination and higher-quality outcomes across construction projects.

Overall, the interviews underscored a collective desire within the industry for comprehensive reforms aimed at enhancing safety, improving workforce skills, strengthening regulatory oversight, and refining management practices. By addressing these areas, stakeholders hope to foster a more efficient, safer, and sustainable construction environment in Malta and beyond.

### 4.3.7. Recommendations for Improvement

Based on the observations and interviews with construction industry professionals in Malta, several critical themes and areas for improvement have been identified. The evaluation of construction site management reveals significant disparities in adherence to optimal standards. While some sites excel in security measures and emergency preparedness, others struggle with basic requirements such as cleanliness, signage, and welfare amenities. These deficiencies not only pose safety risks but also indicate a need for stricter regulatory frameworks and improved industry practices. Compared to best practices observed in the UK, Maltese sites often lack standardized practices in cleanliness, signage, and security measures, highlighting the necessity for comprehensive guidelines to ensure uniform compliance.

Safety and well-being standards also emerged as a major concern. While most sites meet basic PPE requirements, gaps in enforcement and cultural challenges persist. Issues with fall protection, scaffolding safety, and first-aid provisions underscore the need for standardized regulations and enhanced training programs. Language barriers further complicate safety efforts, emphasizing the need for mandatory language and cultural training for foreign workers to improve communication and reduce safety hazards.

Material management practices vary widely across Maltese construction sites, reflecting inefficiencies in handling, storage, and inventory management. While some sites demonstrate proper equipment use and Just-In-Time strategies, others lack organized methods, impacting workflow efficiency and resource optimization. There is a clear need for enhanced training, stricter safety enforcement, and improved management practices to standardise material handling and reduce operational risks.

Environmental management practices also require attention. Waste management, noise control, and water management practices often fall short of international standards, necessitating stronger regulatory oversight and industry education. Improved monitoring systems and adherence to sustainable construction practices are essential to mitigate environmental impact and promote long-term sustainability.

Communication management presents another area for improvement, with inconsistencies noted in the use of visual aids, documentation methods, and feedback mechanisms across

sites. Standardising communication practices, including multilingual signage and centralised documentation systems, can enhance clarity and effectiveness on construction sites, improving overall efficiency and safety

Overall, the interviews highlight a collective desire within the industry for comprehensive reforms aimed at enhancing safety, improving workforce skills, strengthening regulatory oversight, and refining management practices. By addressing these areas through targeted regulatory enhancements, standardised training programs, and cultural integration initiatives, Malta can foster a safer, more efficient, and sustainable construction environment aligned with global best practices.

# 5. Conclusion

## 5.1. Aim of research

This study aimed to identify and highlight gaps in Maltese construction site practices compared to ideal practices in the UK. The research focused on variations from established standards and legislation within Malta's construction industry. By pinpointing these discrepancies, the study sought to inform recommendations for improving legislative frameworks and industry practices. The overarching goal was to enhance safety, efficiency, and compliance on Maltese construction sites, promoting good governance and aligning local practices more closely with international standards.

The research questions answered are the following:

1. What are the prevalent gaps in Maltese construction site practices identified when compared to the ideal construction site practices in the UK?
2. How do these variations compare with established standards and legislations currently employed in the Maltese construction industry?
3. How can the identified gaps in the implementation of construction site practices inform recommendations for improvements in both legislation and industry practices, with the aim of enhancing overall safety, efficiency, and compliance on construction sites and promoting good governance?

## 5.2. Summary of results

The evaluation of construction practices in Malta reveals a landscape marked by significant disparities and opportunities for improvement across various critical themes. This section synthesizes key findings from multiple evaluations to underscore the pressing need for comprehensive reforms in site management, safety standards, material management, environmental practices, and communication strategies within the Maltese construction industry.

Malta's construction site management, as evaluated in Output 1, exhibits notable variations in adherence to optimal standards. While some sites excel in security measures and emergency preparedness, others struggle with basic requirements such as cleanliness, signage, and welfare amenities. These discrepancies not only pose safety risks but also underscore deficiencies in regulatory frameworks and industry practices. A comparison with UK standards highlights clear gaps in standardized practices, emphasizing the necessity for robust guidelines to ensure uniform compliance across all construction sites.

Output 2 delves into safety and well-being standards, revealing mixed adherence to basic Personal Protective Equipment (PPE) requirements and significant enforcement gaps. Issues such as inadequate fall protection, scaffolding safety, and inconsistent first-aid provisions further highlight deficiencies in safety culture and regulatory oversight. Additionally, the study also revealed a lack of mental health support which underscores a systemic neglect of mental

well-being within the construction sector, jeopardizing both worker welfare and productivity and showed an urgent need to address this disparity. The findings emphasize an urgent need for stronger regulatory frameworks and enhanced training programs to align Malta's safety practices with international best practices, thereby fostering a safer working environment.

Material management practices, explored in Output 3, present another area requiring attention. Practices vary widely across Maltese construction sites, from effective material handling and Just-In-Time strategies to inconsistent storage methods and inventory management. Standardising these practices through improved training, stricter enforcement, and organizational standards is crucial to optimizing workflow efficiency and resource utilization, aligning Malta's practices more closely with global standards.

Environmental management practices, discussed in Output 4, reveal shortcomings in waste management, noise control, water management, and air quality management across construction sites. Despite existing regulations, enforcement deficiencies and cultural barriers hinder effective implementation of sustainable practices. Strengthening regulatory oversight, enhancing industry education, and promoting sustainable construction practices are imperative to mitigate environmental impact and ensure long-term sustainability.

Communication management, explored in Output 5, highlights inconsistencies in visual aids, documentation methods, and language barriers across sites. Inadequate provision of translated materials and varying communication strategies undermine efficiency and safety. Addressing these issues through standardized communication practices and clearer regulatory guidelines can enhance clarity and effectiveness on construction sites, ultimately improving overall operational efficiency and safety outcomes.

Insights from industry professionals yielded key themes across interviews, particularly focusing on safety protocols. Concerns highlighted inadequate compliance with PPE, particularly notable among foreign labourers, underscoring the necessity for more rigorous site inspections and adherence to safety standards. Interviewees highlighted the variability in worker competency and advocated for standardized training and certification programs. Language barriers were identified as a significant challenge, suggesting mandatory language and cultural training for foreign workers to enhance communication and safety. Regulatory oversight was also a concern, particularly for smaller projects, with calls for stricter penalties and tailored regulations to ensure consistent adherence to safety standards. Project management and quality assurance were emphasized for minimizing defects and enhancing project success. Greater involvement of management in overseeing construction progress and safety practices was proposed for better coordination and higher-quality outcomes. Ultimately, the interviews revealed a consensus among professionals for reforms aimed at enhancing safety, improving workforce skills, strengthening regulations, and refining management practices to create a safer and more efficient construction environment.

In conclusion, the comprehensive evaluation of Malta's construction industry underscores critical disparities and areas requiring immediate attention to align practices with

international benchmarks. By implementing stricter regulatory frameworks, enhancing training and enforcement mechanisms, and fostering a culture of safety and sustainability, Malta can significantly improve construction practices across the board. These reforms are not only essential for safeguarding worker well-being and enhancing operational efficiency but also for positioning Malta's construction industry as a leader in adopting global best practices for safety, efficiency, and sustainability.

Through concerted efforts and proactive measures, Malta can transform its construction sector into a model of excellence, ensuring that future developments prioritize safety, environmental responsibility, and effective communication. This holistic approach will not only benefit stakeholders within the industry but also contribute positively to Malta's broader socio-economic and environmental goals in the years to come.

## 5.3. Summary of Conclusions

The evaluation of construction site practices in Malta highlights significant disparities compared to best practices identified in the UK literature across critical aspects of site management, physical and mental wellbeing, material management, environmental management, and communication management. Maltese construction sites show inconsistencies in adhering to optimal standards of site management, with notable deficiencies in cleanliness, signage, and welfare amenities, contrasting with more standardized practices seen in the UK. While basic personal protective equipment requirements are generally met, gaps in enforcement and cultural challenges persist, impacting safety practices such as fall protection and first-aid provisions. Material management practices vary widely, ranging from effective handling and storage protocols to lacking organizational standards and efficiency.

Environmental management practices in Malta also fall short, particularly in waste and noise management, indicating a need for stronger regulatory oversight and adherence to sustainable practices similar to those in the UK. Communication management shows inconsistencies in the use of visual aids and documentation methods, hindering effective operational communication compared to more centralized and multilingual strategies advocated in the UK.

The study reveals that existing Maltese regulations regarding construction site practices are not effectively implemented, with inadequate enforcement and regulations often treated as optional rather than mandatory. Several loopholes in the regulations were identified, highlighting the need for amendments that incorporate findings from both the literature review and the current study. For instance, disparities noted in standardized cleanliness practices, zoning signage, and security measures underscore the necessity for comprehensive guidelines ensuring uniform compliance across all Maltese construction sites. Moreover,

regulations concerning certain themes are non-existent, demanding urgent attention to address these gaps.

Despite legislation mandating aspects like site cleanliness, signage, and emergency preparedness, actual adherence varies widely due to financial constraints or cultural attitudes. Strengthened enforcement mechanisms, clearer regulatory guidelines, and potential revisions to existing legislation are essential to align Malta's construction practices more closely with international standards. Urgent attention is needed for areas lacking adequate regulation, aiming to enhance overall safety and operational efficiency in the industry.

Based on interviews and observations within Malta's construction industry, several critical issues emerge. Disparities in site management standards reveal a mixed landscape where some sites excel in security and emergency preparedness while others struggle with fundamental requirements. This underscores the need for stricter regulations and improved industry practices akin to those observed in the UK. Safety concerns include gaps in enforcing PPE standards and challenges in cultural integration, necessitating enhanced training and communication strategies, particularly for foreign workers. Variability in material management practices affects workflow efficiency and resource optimization. Environmental practices, notably in waste and water management, require stronger regulatory oversight and educational efforts. Communication inconsistencies across sites further hinder efficiency and safety.

In conclusion, comprehensive reforms focusing on enhancing safety protocols, improving training, strengthening regulations, and promoting sustainable practices are crucial for fostering a safer, more efficient, and sustainable construction environment in Malta aligned with global standards. Addressing these issues will not only benefit stakeholders within the industry but also contribute positively to Malta's broader socio-economic and environmental goals.

## 5.4. Recommendations for further research

The study investigated construction site management practices on medium-scale sites for comparative analysis within this specific category. Another compelling study could evaluate the adequacy of construction site management practices across different scales, comparing how these practices vary among small, medium, and large-scale construction projects. This would involve conducting additional case studies for each respective scale, initially comparing sites within the same scale to understand their management practices, and subsequently comparing these practices across different scales.

One limitation of this study was its constraint by time, conducting only eight case studies with single-site visits. It recommends future research adopt a longitudinal approach with multiple visits to various sites over extended periods, possibly even observing management practices across project phases beyond civil works.

The study highlights concern about worker skills and risk awareness, suggesting further research into the effectiveness of training programs in Malta compared to leading countries, aiming to enhance these programs.

Additionally, the study's focus on the UK as a benchmark for construction practices is noted as limiting, potentially overlooking globally superior practices. It focuses on five specific areas of best practices, potentially neglecting other critical aspects of effective construction site management. Future studies are urged to explore broader practices and compare them internationally.

In conclusion, this topic requires greater attention, and the local construction industry should be regulated as rigorously as other industries. The statements outlined above could guide future research efforts to improve the Maltese construction industry. Recognizing the significance of this industry is crucial to avoiding further unfortunate events. As Prof. Alex Torpiano noted in his final address as president of the Kamra tal-Periti, "*the situation is far from satisfactory*" (Torpiano, 2019), underscoring the need for more research and efforts to enhance the situation.

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# 7. Appendices

| | |
|---|---|
| Appendix 1 | Observational Questions |
| Appendix 2 | Semi-Structured Interview Questions |
| Appendix 3 | Consent Form |

## 7.1. Appendix 1

| | OBSERVATIONAL CHECKLIST | | | | |
|---|---|---|---|---|---|
| Section | Inspection Theme | Yes | No | N. A | Obser. |
| A | Site Management | | | | |
| A.1 | Site Organization & Cleanliness | | | | |
| 1 | Are the majority of work areas clean and tidy? | | | | |
| 2 | Are there any piles of waste that should be removed? | | | | |
| A.2 | Signage for different zones | | | | |
| 1 | Are different work zones clearly delineated? | | | | |
| 2 | Are there clear and visible signs indicating important information? (e.g. emergency exits, hazard warnings?) | | | | |
| A.3 | Security Measures | | | | |
| 1 | Are security measures in place to protect the site from unauthorized access? | | | | |
| 2 | Is there surveillance or monitoring to prevent theft and vandalism? | | | | |
| A.4 | Welfare Amenities | | | | |
| 1 | Are temporary facilities well-organized and maintained? | | | | |
| 2 | Is there sufficient provision at breaks and lunchtimes? | | | | |
| A.5 | Pedestrian Management | | | | |
| 1 | Are segregating barriers secure? | | | | |
| 2 | Are walkways being used correctly? | | | | |
| A.6 | Fire & Emergency Preparedness | | | | |
| 1 | Are fire extinguishers available and certified? | | | | |
| 2 | Are emergency exits clearly marked and accessible? | | | | |
| A.7 | Section Comments | | | | |

| B | Physical & Mental Wellbeing | | | | |
|---|---|---|---|---|---|
| B.1 | Personal Protective Equipment (PPE) | | | | |
| 1 | Are the majority* of workers wearing appropriate PPE such as safety glasses, hard hats, steel-toed boots and gloves? | | | | |
| 2 | Is there proper signage indicating mandatory PPE in specific areas? | | | | |
| B.2 | Fall Protection | | | | |
| 1 | Are guardrails, safety nets, or personal fall arrest systems in place in elevated work areas? | | | | |
| 2 | Do construction workers secure themselves with safety harnesses when working at heights? | | | | |
| B.3 | Scaffolding Safety | | | | |
| 1 | Is scaffolding erected according to safety regulations? | | | | |
| 2 | Is scaffolding used properly by workers? | | | | |
| B.4 | First Aid & Medical Facilities | | | | |
| 1 | Are first-aid kits available and well-stocked? | | | | |
| 2 | Is there a designated area for medical assistance, and are contacts readily available to contact first aiders in case of medical assistance? | | | | |
| B.5 | Plant & Equipment | | | | |
| 1 | Can construction plants move and operate safely? | | | | |
| 2 | Is there a designated traffic management plan to ensure that pedestrians and other vehicles are safely separated from moving machinery? | | | | |
| B.6 | Mental Well-being | | | | |
| 1 | Is there a culture of support and fellowship among workers? | | | | |
| 2 | Is information about mental health support services readily available and promoted on site? | | | | |
| B.7 | Section Comments<br>*Majority = +55% | | | | |

| C | Material Management | | | | |
|---|---|---|---|---|---|
| C.1 | Material Handling | | | | |
| 1 | Are materials transported using appropriate equipment? | | | | |
| 2 | Are materials stacked or stored in a way that minimizes the risk of collapse or falling? | | | | |
| C.2 | Material Storage | | | | |
| 1 | Is there proper organization and segregation of construction materials? | | | | |
| 2 | Are there designated storage areas for different types of materials? | | | | |
| C.3 | Inventory Management | | | | |
| 1 | Are materials tagged or labelled with essential information, such as quantity, type, and date received? | | | | |
| 2 | Is there a system in place to track material inventory levels? | | | | |
| C.4 | Just-In-Time (JIT) Implementations | | | | |
| 1 | Is the concept of Just-in-Time (JIT) deliveries implemented at the construction site? | | | | |
| C.5 | Section Comments | | | | |

| D | Environmental Management | | | | |
|---|---|---|---|---|---|
| D.1 | Waste Management | | | | |
| 1 | Is there a system in place for sorting and recycling construction waste? | | | | |
| 2 | Is there a plan for the safe disposal of hazardous construction materials? | | | | |
| D.2 | Noise Management | | | | |
| 1 | Are noise levels monitored at several locations across the site? | | | | |
| 2 | Are there designated areas for noisy activities to minimize disturbance to surrounding areas? | | | | |
| D.3 | Water Management | | | | |
| 1 | Are there any observable initiatives to capture and reuse water from processes or rainwater runoff? | | | | |
| 2 | Are there measures in place to prevent runoff of pollutants into the streets during rain events? | | | | |
| D.4 | Air Quality Management | | | | |
| 1 | Are measures in place to control dust and airborne pollutants? | | | | |
| 2 | Is construction equipment properly maintained to reduce emissions and dust spread? | | | | |
| D.5 | Section Comments | | | | |

| E | Communication Management | | | | |
|---|---|---|---|---|---|
| E.1 | General Communication | | | | |
| 1 | Are there reliable communication tools and infrastructure, such as radios or mobile devices? | | | | |
| 2 | Are visual aids employed to convey essential messages effectively to workers? | | | | |
| E.2 | Cultural and Linguistic Consideration | | | | |
| 1 | Are visible communication materials translated for diverse language groups on the site? | | | | |
| 2 | Are there visible signs of language barriers impacting communication among workers? | | | | |
| E.3 | Communication Documentation | | | | |
| 1 | N. A | | | | |
| 2 | N. A | | | | |
| E.4 | Feedback Mechanism | | | | |
| 1 | N. A | | | | |
| 2 | N. A | | | | |
| E.5 | Section Comments | | | | |

## 7.2. Appendix 2

### A. Site Management

#### i. Signage for Different Zones

##### Affirmative Response to Checklist A.2

How often do you review and update signage to adapt to changing conditions or requirements?

##### Negative Response to Checklist A.2

Why hasn't signage been provided? Are there alternative methods for conveying information?

#### ii. Security Measures

##### Affirmative Response to Checklist A.3

How do you ensure security beyond working hours?

##### Negative Response to Checklist A.3

Could you provide further detail on the function of surveillance systems or security personnel in upholding site security, and explain the reasons for the current deficiency in security measures?

#### iii. Welfare Amenities

##### Affirmative Response to Checklist A.4

Are there regular inspections or maintenance routines in place to ensure the facilities remain functional and sanitary? Are there any specific guidelines or standards you follow in the provision and maintenance of welfare facilities?

##### Negative Response to Checklist A.4

Could you elaborate on the reasons for the apparent neglect and lack of interest in establishing and maintaining proper worker welfare facilities?

#### iv. Traffic Management

##### Affirmative Response to Checklist A.5

Are there specific procedures in place for the delivery and movement of materials and equipment?

##### Negative Response to Checklist A.5

Could you provide further details on why there seems to be a deficiency in traffic and pedestrian management on the site?

## v. Fire and Emergency Preparedness

### Affirmative Response to Checklist A.7

What measures are in place for emergency preparedness, including escape routes, fire safety protocols, and placement of fire extinguishers?

### Negative Response to Checklist A.7

Could you provide further details on why there seems to be a deficiency in emergency preparedness and fire safety?

## B. Physical & Mental Wellbeing

### i. Personal Protective Equipment

#### Affirmative Response to Checklist B.1

What measures are in place to ensure that workers are equipped with the necessary personal protective equipment?

#### Negative Response to Checklist B.1

How does your construction site prioritize safety practices?

### ii. Scaffolding Safety

#### Affirmative Response to Checklist B.3

How does your site ensure that scaffolding is erected, inspected, and maintained according to safety standards?

#### Negative Response to Checklist B.3

What measures are in place to prevent falls from scaffolding, considering it's one of the primary factors leading to fatal accidents in the construction industry?

### iii. First-Aid and Medical Facilities

#### Affirmative Response to Checklist B.4

Are there designated personnel trained in first aid, and how often are their skills updated or refreshed?

#### Negative Response to Checklist B.4

Considering the absence of first aid kits on-site and the lack of designated areas for medical treatment, could you clarify if there are any available first aid provisions on-site and elaborate on how they are accessible to workers in case of emergencies?

### iv. Mental Well-being

#### Affirmative Response to Checklist B.6

Are there any specific initiatives or support mechanisms in place to promote mental well-being within your workforce?

#### Negative Response to Checklist B.4

Is mental health addressed in any capacity? If so, how does your site tackle mental health concerns among workers?

## v. Training and Education

### Extra to Checklist

Are training programs provided to workers regarding safety practices and the proper use of equipment?

X

## C. Material Management

### i. Material Handling

#### Affirmative Response to Checklist C.1

Can you describe any challenges or issues your team faces regarding material handling, and how do you address them?

#### Negative Response to Checklist C.1

What measures do you adopt to minimize material damage or loss during handling processes?

### ii. Material Storage

#### Affirmative Response to Checklist C.2

How do you ensure that materials are stored in a way that minimizes the risk of damage, theft, or deterioration?

#### Negative Response to Checklist C.2

What criteria do you use to determine the location and layout of material storage areas on-site?

### iii. Inventory Management

#### Affirmative Response to Checklist C.3

How do you track the usage and consumption of materials throughout the duration of the project?

#### Negative Response to Checklist C.3

If there is no system in place to track material inventory levels, what strategies do you employ to prevent overstocking or understocking of materials?

### iv. Just-in-Time Implementations

#### Affirmative Response to Checklist C.4

What factors would influence your decision to adopt JIT delivery methods, and what benefits do you anticipate?

#### Negative Response to Checklist C.4

Have you considered implementing just-in-time (JIT) delivery strategies for materials on your construction project? Why?

## D. Environmental Management

### i. Waste Management

#### Affirmative Response to Checklist D.1

Are there any challenges or barriers faced in implementing effective waste management practices, and how are they addressed?

#### Negative Response to Checklist D.1

If there isn't a system in place for sorting and recycling construction waste, how is construction waste typically managed on this site?

### ii. Noise Management

#### Affirmative Response to Checklist D.2

How do you assess and monitor noise levels on-site, and what actions are taken if noise limits are exceeded?

#### Negative Response to Checklist D.2

Are there any strategies employed to mitigate noise pollution during construction activities? If so what are they?

### iii. Water Management

#### Affirmative Response to Checklist D.3

What steps are taken to prevent water contamination and manage runoff from the construction site?

#### Negative Response to Checklist D.3

Are there any measures to conserve water usage during construction activities? And if so can you describe them?

### iv. Air Quality Management

#### Affirmative Response to Checklist D.4

What measures are implemented to control dust and airborne pollutants generated during construction activities?

#### Negative Response to Checklist D.4

What do you believe is the reason behind the lack of interest in implementing measures to control dust, and pollution, and decrease emissions?

## E. Communication Management

### i. Cultural and Linguistic Consideration

#### Affirmative Response to Checklist E.2

Given the prevalence of foreign workers in the construction industry, how do you address communication challenges in multilingual environments on your construction sites?

#### Negative Response to Checklist E.2

Are there any means of communication available to convey important messages and instructions to foreign workers? If yes what are they?

### ii. Communication Documentation

- How do you ensure that communication within your construction projects is effectively documented?
- Can you describe any instances where clear documentation of communication helped resolve conflicts or mitigate risks during a construction project?

### iii. Feedback Mechanisms

- Do you encourage a culture where feedback is actively solicited from colleagues and subordinates within your construction projects? If yes, how?
- How do you currently integrate feedback mechanisms from workers within your construction projects?

## 7.3. Appendix 3

**Information about the study**

My name is Anna Marie Meilak and I am a final year masters student at the University of Malta, reading for a masters in structural engineering with project management. I am presently conducting research as part of my dissertation titled *An audit exercise to identify gaps in the implementation of construction site management practices through observational data collection*; this is being supervised by Prof. Perit Dr. Rebecca Dalli Gonzi - rebecca.e.dalli-gonzi@um.edu.mt. The aim of my study is to evaluate the current construction site practices and legislation and analyse if there is a gap between what is being said on paper and what is being implemented on site in terms of construction site management. I intend to evaluate the implications and causes of the identified gaps and allow for triangulation of data by analysing the current law, observing what is happening on site and comparing with ideal standards in the UK. Finally, I will be able to provide recommendations for improvement and reduce the occurrence of incidents on sites and allow for higher quality work.

**Your Participation**

Any data collected from this research will be used solely for purposes of this study.

Should you choose to participate, you will be asked to provide reasons for the observations I made on site and respond to further questions that will cover aspects which are not readily observable on site.

Data collected will be collected through use of a semi-structured interview which will be done after I personally conduct the site audit checklist to collect observable data on site. The interview will occur once and will only take about 30 minutes of your time.

Participation in this study is entirely voluntary; in other words, you are free to accept or refuse to participate, without needing to give a reason.

You are also free to withdraw from the study at any time, without needing to provide any explanation and without any negative repercussions for you. Should you choose to withdraw, any data collected from you will be erased as long as this is technically possible (for example, before it is anonymised or published), unless erasure of data would render impossible or seriously impair achievement of the research objectives, in which case it shall be retained in an anonymised form.

If you choose to participate, please note that there are no direct benefits to you. Your participation does not entail any known or anticipated risks.

**Data Management**

The data collected will be anonymised. The data will be stored on my laptop in an excel file and only I will have access to it together with my supervisor Prof. Perit Dr. Rebecca Dalli Gonzi.

Please note also that, as a participant, you have the right under the General Data Protection Regulation (GDPR) and national legislation to access, rectify and where applicable ask for the data concerning you to be erased.

All data collected will be erased following publication of the study. Your identity will be revealed/attributed only with your consent.

Should there be any incidental findings these will also be listed however everything will remain anonymous.

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**Participant's consent**

- ☐ I hereby declare to have read the information about the nature of the study, my involvement and data management.
- ☐ I have had the opportunity to ask questions about the study and my questions have been satisfactorily answered.
- ☐ I declare that I am 18 years or older.
- ☐ I understand that should I have any further queries, I can contact Anna Marie Meilak (anna.m.meilak.18@um.edu.mt) or Prof. Perit Dr. Rebecca Dalli Gonzi (rebecca.e.dalli-gonzi@um.edu.mt)
- ☐ I agree to participate in this research study.

**MARK ONLY IF APPLICABLE**

- ☐ I agree to be identified in the research records.
- ☐ I agree to be identified in the research publications.

_____ _____

Participant's name (in block) Researcher's name (in block)

_____ _____

Participant' signature Researcher's signature

_____

Date