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BARRIERS TO THE ADOPTIONS OF PREVENTION THROUGH DESIGN (PtD) IN THE CONSTRUCTION INDUSTRY

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Saudi Arabia's construction industry is expanding rapidly, with many large-scale projects still in the design phase. This study explores the barriers to adopting Prevention through Design (PtD) in the country's construction sector. Using semi-structured interviews with nine experts and thematic analysis, key challenges were identified, including regulatory limitations, lack of awareness, high costs, insufficient training, resistance to change, and limited industry support. Despite PtD's proven benefits in enhancing safety and sustainability, its adoption remains minimal. Regulatory constraints hinder integration, while the lack of education and financial incentives discourages implementation. Additionally, many stakeholders resist shifting from traditional practices. To promote PtD adoption, this study recommends increasing awareness, enhancing training programs, revising regulations, providing financial incentives, and fostering collaboration among industry stakeholders. These findings offer valuable insights for policymakers and construction leaders aiming to enhance workplace safety and sustainability. Addressing these challenges can help accelerate PtD implementation, leading to safer and more efficient construction practices in Saudi Arabia.

Keywords: Safety, Design phase, Government, Prevention, Saudi Arabia.

1 INTRODUCTION

The construction industry is an essential to Saudi Arabia, significantly contributing to economic growth and national development. Saudi Arabia is set to become the world's largest construction market, driven by substantial investments aimed at revitalizing and diversifying the economy (Burke 2024). According to Burke (2024), the total construction output in the country is projected to reach USD 181.5 billion by the end of 2028, reflecting a nearly 30% increase compared to the levels seen in 2023. However, despite the sector's rapid growth, the construction industry in Saudi Arabia continues to face a concerning safety challenge (Mosly 2022). The sector experiences a higher number of accidents compared to others, underscoring the urgent need for improved safety protocols, better risk management, and stronger regulatory enforcement (Mosly 2022).

Saudi Arabia's Vision 2030 includes several iconic mega-projects, such as Neom, The Red Sea Project, Mukaab, Riyadh Sports Boulevard, King Salman Park in Riyadh, and Qiddiya (Kingdom of Saudia Arabia 2016). As projects become larger and more technologically advanced, the risk of accidents increases due to factors such as labor-intensive operations, high-risk activities, and inadequate hazard prevention measures, significantly amplifies safety challenges in the industry (Almaskati *et al.* 2024). In 2014, around 69,241 work-related accidents were reported in Saudi Arabia, with the construction sector accounting for 51.35% of these incidents (Mosly 2022). This

highlights the industry's high-risk nature and the urgent need for improved safety measures and stricter regulations to protect workers.

To effectively mitigate these risks, a comprehensive and proactive safety strategy is essential. This includes the integration of Prevention through Design (PtD) principles, the adoption of cutting-edge safety technologies, and the enforcement of more stringent safety regulations and policies. Since the majority of construction projects in Saudi Arabia are still in the design phase, there is a unique opportunity to incorporate PtD strategies early on, ensuring that safety measures are embedded into project planning and execution from the start.

Prevention through Design (PtD) focuses on eliminating hazards at the design stage rather than addressing them later during construction or maintenance (Samsudin *et al.* 2022). By incorporating safety considerations early in the project lifecycle, PtD reduces workplace risks, minimizes costly modifications, and enhances overall project efficiency (Samsudin *et al.* 2023).

Despite its proven benefits, PtD adoption in Saudi Arabia remains limited. This paper examines the challenges hindering the adoption of Prevention through Design (PtD) in Saudi Arabia's construction industry, highlighting key barriers to its implementation.

2 MATERIALS AND METHODS

This research aimed to explore the challenges hindering the adoption of Prevention through Design (PtD) in Saudi Arabia's construction industry. To address these research gaps, the author employed a qualitative approach, conducting semi-structured interviews with seven industry experts. The study's methodology followed a three-step process, including the design and structure of the method, data collection, and data analysis, which was carried out using content analysis techniques.

2.1 Method Design and Structure

The study adopted a qualitative approach to explore the challenges hindering the adoption of Prevention through Design (PtD) in the construction industry. Semi-structured interviews were conducted with industry experts to gather in-depth insights, allowing for a flexible yet structured discussion that covered key topics. This approach ensured a comprehensive understanding of the barriers, industry perspectives, and potential solutions for integrating PtD into construction practices.

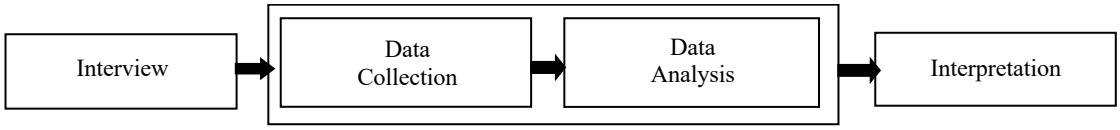

Figure 1. Proposed qualitative research method adopted from Creswell and Clark (2007).

Figure 1 shows the visualization of the qualitative methods design procedure proposed by Creswell and Clark (2007). This approach incorporates methods such as interviews, observations, and open-ended questionnaires to gather in-depth insights.

2.2 Data Collection

The author conducted both face-to-face and online semi-structured interviews with nine construction experts in the industry, following Creswell's (2009) qualitative research approach. Most interview participants were based in the Riyadh Province of Saudi Arabia, where the headquarters of major mega projects are located. The interviews were conducted in various

settings, including community centers, urban areas, and workplaces, to ensure a diverse range of insights from different professional environments. The interviews were stopped when saturation was reached, meaning no new information or insights were being gathered, and the same themes or patterns were consistently emerging across participants.

Table 1. Demographics of the participants.

Participants	Organization Type	Current Position	Years Of Experience
P1	Contractor	Construction Manager	8
P2	Contractor	Construction Manager	7
P3	Consultant	Project Manager	7
P4	Facility Management	Executive Director	14
P5	Safety	Safety Director	12
P6	Contractor	Structure Engineer	4
P7	Consultant	Project Manager	6
P8	Project Owner	Project Owner	12
P9	Contractor	Architectural Engineer	5

Table 1 presents the background and years of experience of the interviewees, providing context for the insights gathered during the interviews.

2.3 Data Analysis

The author applied content analysis to the interview data, aiming to identify patterns, themes, and trends by quantifying and interpreting the frequency of different categories. Both literal and interpretive analyses were used: literal analysis focused on organizing the explicit elements, while interpretive analysis explored the deeper meanings and relationships. To improve the validity and reliability of the results, several validation methods were utilized. These included developing the interview guide based on an extensive literature review, refining it with input from a senior peer, verifying the findings with participants through member checking, and using triangulation, where multiple researchers independently analyzed the data and addressed discrepancies to ensure consistency and reduce bias.

3 RESULTS

Through the qualitative data analysis, two primary themes emerged from the personal interviews: industry-related factors (focusing on projects and designers) and government-related factors. These themes were then expanded upon with several sub-themes, providing a detailed understanding of the barriers to adopting Prevention through Design (PtD) within Saudi Arabia's construction industry.

Table 2 offers a comprehensive overview of these categories, themes, and sub-themes, offering a structured approach to understanding the key barriers that need to be addressed to facilitate the successful adoption of PtD in the industry.

The designer perspective included limited knowledge and understanding of PtD principles (20.6%) and resistance to adopting new practices (14.3%). The project perspective highlighted cost concerns (14.3%), a lack of proper training and skilled workers (10.9%), and poor collaboration among stakeholders (9.4%).

In the government-related category, weak regulations and lack of enforcement were identified as a major barrier (14.1%), followed by a lack of incentives to encourage PtD adoption (9.5%) and gaps in government safety policies (6.9%).

Table 2. Categories, themes and subthemes of the key barriers to adopt the PtD.

Theme	Subtheme	%
Category	*Designer*	
Industry-related	Limited knowledge and understanding of PtD principles	20.6
	Resistance to adopting new practices	14.3
	Project	
	Increase the cost of the project	14.3
	Lack of proper training and skilled workers	10.9
	Poor collaboration between different stakeholders	9.4
Government-related	Weak regulations and lack of enforcement	14.1
	Lack of incentives to encourage PtD adoption	9.5
	Gaps in government safety policies	6.9
	Total	100

4 DISCUSSIONS

The study identified two main barriers to adopting Prevention through Design (PtD) in Saudi Arabia's construction industry: industry-related and government-related factors. These findings align with Al-Bayati *et al.* (2024), who categorized into industry, project, designer, and client related domains. However, the factors identified in this study further highlight the unique challenges in the Saudi context.

4.1 Industry-related Factors

Two key themes emerged within industry-related factors: the designer perspective and the project perspective.

4.1.1 *Designer perspective*

One of the key barriers identified is the limited knowledge and understanding of PtD principles, with many designers unfamiliar with how to integrate safety measures into the early design stages. This lack of awareness results in missed opportunities to eliminate hazards before construction begins. Interestingly, one designer mentioned that PtD principles seem more relevant to designing prisons and psychiatric hospitals, where the primary goal is to protect occupants within these facilities.

- ***P9***: *"I believe one of the biggest challenges for adoption the PtD principles is that we had never heard of it before. However, I used a similar idea when designing psychiatric hospitals."*

Another major challenge is resistance to adopting new practices. Many designers are accustomed to traditional methods and may be reluctant to incorporate PtD strategies due to concerns about increased workload, lack of technical expertise, or unfamiliarity with safety-focused design approaches.

- ***P6***: *"We've been designing buildings like this for years. Changing things now could make the process harder and slow down approvals. I'm also unsure how to add these safety measures without impacting the design's look and function."*

4.1.2 *Project perspective*

One of the major barriers identified in the project perspective is the concern over increased costs when adopting PtD principles. Many in the industry worry that implementing safety-focused

design strategies may lead to higher project expenses, which could strain budgets and complicate the planning process. As one professional mentioned, the additional costs may not be feasible, especially in a highly competitive market where cost-efficiency is prioritized.

- ***P7:*** *"Introducing these safety measures might drive up the cost of the project. It's hard to justify those additional expenses when we're already working with tight budgets."*

Another challenge highlighted was the lack of proper training and skilled workers. Many construction professionals feel that the workforce is not equipped with the necessary knowledge or expertise to effectively implement PtD strategies. This shortage of skilled personnel further complicates the integration of safety measures into the design and construction process

- ***P4:*** *"We just don't have enough trained people who can implement these new safety measures. Without the right skills, it's hard to make PtD work effectively on our projects."*

4.2 Government-related Factors

Government-related factors also play a significant role in hindering the adoption of Prevention through Design (PtD) in the construction industry. One of the most critical challenges identified are weak regulations and lack of incentives to encourage PtD adoption. Many professionals feel that existing safety policies are either insufficient or not strictly enforced, making it difficult to prioritize PtD principles in project planning and execution.

- ***P3:*** *"There are some safety regulations, but enforcement is inconsistent. If there were stricter rules or some form of incentive, companies would take safety design more seriously."*

In addition to weak regulations and lack of enforcement, some designers face limitations due to strict building codes that make it difficult to implement PtD principles. While building codes are essential for ensuring structural integrity and compliance, they may not always prioritize safety in the early stages of design.

- ***P1:*** *"We have to follow the building codes strictly, and sometimes they don't leave much room for incorporating additional safety measures. If PtD principles contradict certain code requirements, we have no choice but to comply with the code."*

Gaps in government safety policies further contribute to the slow adoption of PtD. Many regulations do not specifically address the integration of safety into the early design stages, leading to a reactive rather than proactive approach to hazard prevention.

- ***P8:*** *"The current policies focus more on safety during construction rather than preventing hazards in the design phase. If regulations required PtD from the start, it would change how we approach safety."*

5 CONCLUSIONS

This study highlights the key barriers hindering the adoption of Prevention through Design (PtD) in Saudi Arabia's construction industry, categorizing them into industry-related and government-related factors. The findings reveal that limited awareness, resistance to change, cost concerns, and a lack of skilled professionals significantly hinder PtD adoption within the industry. Additionally, weak regulatory frameworks, inconsistent enforcement, and restrictive building codes further contribute to the slow implementation of safety-focused design strategies.

Despite these challenges, the integration of PtD presents a valuable opportunity to enhance safety, reduce workplace hazards, and improve project efficiency. Given that many large-scale

construction projects in Saudi Arabia are still in the design phase, now is the ideal time to incorporate PtD principles early in the project lifecycle.

To promote PtD adoption, this study recommends targeted strategies, including increasing awareness through training programs, revising regulations to mandate PtD integration, providing financial incentives, and fostering collaboration among industry stakeholders. By addressing these barriers, Saudi Arabia's construction industry can transition toward safer, more sustainable, and efficient building practices, ultimately supporting the nation's long-term development goals under Vision 2030.

This study offers valuable insights into PtD adoption barriers in Saudi Arabia, but the small sample size of nine experts may limit generalizability. While suitable for qualitative research focused on depth over breadth, broader studies with more diverse participants are needed to confirm and extend these findings.

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