

Exploring the Reasons Behind Hard Hat Non-Compliance Among Filipino Site Workers: A Qualitative Study

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Abstract

This study explores the reasons behind hard hat non-compliance among Filipino site workers and introduces a technological concept to improve safety compliance at construction sites. A qualitative approach is used through in-depth interviews with project managers, safety officers, and site workers within Metro Manila, all of whom regularly use hard hats. The researcher follows the six steps of systematic thematic analysis to identify common patterns and themes. Findings indicate that workers often remove or fail to properly wear their hard hats due to discomfort caused by heat, poor fit, strap irritation, and low-quality materials (i.e., ergonomic factors). Other reasons include lack of safety training, weak enforcement of safety rules, and complacency, as many workers wear helmets only when supervisors are nearby (i.e., behavioral factors and management factors). These actions increase the risk of head injuries, cause work stoppages, and lead to delays in operations. Both ergonomic, behavioral, and management factors therefore influence non-compliance. To address these issues, the study proposes the anti-strip belt technology, an engineering control designed to monitor and prevent the removal of hard hats while workers are at work. The participants express support for this concept, recognizing its potential to strengthen safety monitoring and compliance. The study concludes that combining proper training, strict supervision, and technology-driven safety systems can reduce non-compliance and improve worker safety. This research contributes to the growing body of literature on human factors, ergonomics, and workplace safety management.

Keywords

In-depth Interview, Overall Site Safety, Project Officers, Qualitative Research, and Thematic Analysis

1. Introduction

The construction industry is widely recognized as one of the most hazardous work sectors, with many accidents and injuries resulting from unsafe practices and weak safety compliance (Adebeyi et al. 2020; Newaz et al. 2025). Wearing a hard hat is one of the simplest yet most important safety requirements, as it protects workers from head injuries and falling objects. However, despite strict regulations, many construction workers continue to remove or misuse their hard hats while on duty (Choudhry and Fang 2008). In the Philippines, this problem remains widespread, indicating that the safety culture among Filipino workers is still in its developmental stage. According to (Jitwasinkul and Hadikusumo 2011), workers' safety behavior is shaped by factors such as comfort, supervision, and risk awareness, which influence their use of personal protective equipment (PPE). While previous studies examine general safety

compliance, limited research specifically focuses on the behavioral and contextual reasons for hard hat non-compliance among Filipino site workers. This research gap highlights the need to explore workers' attitudes, environmental conditions, and management practices that contribute to this recurring safety issue. This study is grounded in the Safety Climate Theory and the Behavior-Based Safety (BBS) approach, which explain how workers' perceptions of safety culture and individual habits influence compliance. The Safety Climate Theory suggests that when management prioritizes safety, workers are more likely to follow safety rules. Meanwhile, the BBS approach emphasizes that unsafe actions, such as removing hard hats, often stem from learned behaviors and comfort-based decisions. Using these theories helps the study understand how both organizational culture and personal attitudes shape non-compliance behavior. To address this gap, the study aims to explore the reasons behind hard hat non-compliance among Filipino site workers and to propose a technological solution that improves safety compliance. A qualitative design is used because it allows the researcher to gain in-depth insights into workers' experiences, perceptions, and motivations, factors that cannot be easily measured through surveys or numerical data. Through in-depth interviews, the study identifies key themes related to comfort, supervision, and safety awareness. Guided by (Ajslev et al. 2022), who emphasize the effectiveness of engineering controls over administrative measures, the research proposes the Anti-Strip Belt technology, a design intended to monitor and prevent the removal of hard hats. The study ultimately aims to enhance workplace safety by combining behavioral understanding, management support, and technological innovation.

1.1 Problem Statement

The study addresses three major gaps identified in existing literature. First, it responds to a contextual gap by focusing on the Filipino construction environment, which remains underrepresented in studies on PPE compliance. Most prior research originates from international settings such as China, Nigeria, and Europe, where cultural, environmental, and regulatory conditions differ significantly. By situating the investigation within the Philippines—characterized by tropical work conditions, informal supervision practices, and a developing safety culture—this study provides a localized understanding of the ergonomic and behavioral causes of PPE non-compliance. Second, the study bridges a behavioral gap by moving beyond policy analysis toward a deeper examination of actual worker behavior. While existing studies often emphasize compliance with safety protocols, they rarely explore the reasons behind deviations from such policies. Through qualitative interviews, this research captures the lived experiences, motivations, and perceptions of construction workers, offering insight into why PPE is sometimes removed or misused despite adequate awareness of safety requirements. Lastly, the study addresses a technological gap by proposing an engineering-based intervention that complements traditional administrative and training measures. The introduction of the Anti-Strip Belt represents an innovative step toward integrating technological control mechanisms within behavioral safety systems. This device operationalizes the link between human factors and engineering design, providing a tangible, preventive solution to improve PPE adherence in construction environments.

1.2 Objectives

The study explores the reasons behind hard hat non-compliance among Filipino site workers and proposes a technological intervention that enhances safety compliance, minimizes the removal of hard hats, and ultimately reduces safety risks and accidents at construction sites.

1. To identify the common reasons why site workers remove or do not properly wear their safety helmets at project sites.
2. To analyze the impact of improper hard hat use on worker safety and overall site accident risks.
3. To initiate the concept of a technological or engineering control solution that can monitor and minimize the removal of hard hats, thereby improving safety compliance and reducing potential hazards on-site.

2. Literature Review

The reviewed literature highlights that hard hat non-compliance among construction workers remains a critical safety issue influenced by multiple factors:

2.1 Ergonomic Factors

Previous studies have shown that many workers remove their hard hats due to physical discomfort and poor design. (Jitwasinkul and Hadikusumo 2011) and (Nadhim et al. 2016) found that heat, poor ventilation, and heavy helmet materials made workers feel uncomfortable during prolonged work hours. Many workers believed that helmets caused sweating, itching, and neck strain, which led them to remove them. (Lingard and Rowlinson 2004) also noted that the

use of poor-quality materials and improper fitting designs made safety helmets less appealing to wear. These findings suggest that when PPE is not ergonomically designed, compliance naturally decreases.

2.2 Behavioral Factors

Unsafe behaviors were also a major cause of non-compliance. (Choudhry and Fang 2008) explained that non-compliance was not only caused by discomfort but also by weak safety culture and poor supervision. Many workers did not fully understand the risks of not wearing helmets, especially when they had not received proper safety training. (Griffin et al. 2020) observed that workers tended to wear hard hats only when supervisors or safety officers were nearby, indicating that compliance was often driven by fear rather than awareness. This behavior reflected a reactive safety attitude, where rules were followed only under observation rather than from personal commitment to safety.

2.3 Management and Technological Factors

Other studies had shown that management practices and technology played important roles in improving safety compliance (Cheng et al. 2004). (Lingard and Rowlinson 2004) emphasized that some companies failed to provide quality PPE or to enforce its consistent use. (Ajslev et al. 2022) suggested that introducing engineering and technological interventions could help reduce human error and improve monitoring. New helmet designs and sensor-based technologies were proposed to help ensure that protective equipment stayed in place and was worn correctly. These studies supported the idea that combining management enforcement, worker awareness, and technology-driven solutions could improve compliance and reduce construction site accidents.

2.4 Impacts of PPE Non-Compliance in the Philippine Context

In the Philippine construction industry, violations of occupational safety standards remain a serious concern, frequently resulting in penalties, fines, and work stoppages. The Department of Labor and Employment (DOLE), through the Occupational Safety and Health Standards (OSHS) and Republic Act No. 11058, enforces strict regulations to ensure the protection of workers. The law mandates employers to provide appropriate personal protective equipment (PPE), such as hard hats, and to maintain safe working environments (Department of Labor and Employment (DOLE, 2018). Failure to comply with these requirements can result in significant administrative and financial consequences. Under Republic Act No. 11058, DOLE may impose fines of up to ₱100,000 per day for each violation that exposes workers to risks of death or serious injury. Repeat or willful violations may also lead to heavier penalties and possible suspension of operations (DOLE, 2018).

2.5 Impacts of PPE Non-Compliance in the Developing Countries

In Port Said, Egypt, about 60% of workers use PPE during work. The main reasons for non-use are discomfort, lack of knowledge on how to use it, and poor fit. Occupational accidents in the last 12 months were reported by 64.3% of workers. The main accident types were: being hit by falling objects, falls from height, and tool-related accidents. (Sehsah et. al 2020).

3. Methods

This study explored the reasons why Filipino site workers did not consistently wear hard hats. A qualitative research design was used, specifically through in-depth interviews. According to (Erlandson et al. 1993), qualitative research accepts that people have different realities, allows a more holistic approach, and recognizes the natural influence of both the researcher and the participants on the data. Because of this, the researcher was able to provide richer descriptions and a deeper understanding of the situation, as also supported by (Phillips 1997) and (Guba 1981). This showed that the scientific community recognized qualitative research as a flexible method, comparable to the more commonly used quantitative approach. Thematic analysis was employed to identify the major and common themes among all participants, based on the semi-structured interview questions. The interviews were conducted to understand and compare the perspectives of project managers, safety officers, and site workers, both individually and collectively.

3.1 Participants

Interviews were conducted with Filipino project managers and safety officers from different job sites across Metro Manila. Most of the participants in this group were Mechanical Engineers, aged between 26 and 52 years old, with approximately 88.5% being male, as shown in Table 1. Another group of participants consisted of Filipino site workers, aged 25 to 50 years old, all of whom were male. Most of these workers were employed as site engineers or technicians in various construction projects within Metro Manila, as shown in Table 2. Each interview was conducted in a single session, with an average duration of 7 to 15 minutes. Around 81.25% of the interviews were conducted

face-to-face in a meeting room, while 18.75% were done online via Microsoft Teams. The number of participants followed the recommendation of (Guest et al. 2020), who stated that 10 to 15 participants are enough to reach theoretical saturation in qualitative interviews.

Table 1. General information about Project Managers/Safety Officer

No	Name	Particulars				
		Gender	Age	Professional Title	Company	Years in the Company
1	Frederick Gabatin	Male	52	Safety Officer	Crimson Group Inc	3
2	Geomarie De Guzman	Male	30	Assistant Manager Consultant	Daikin Airconditioning	4
3	Royce Albert Tejadilla	Male	29	Assistant Manager	Daikin Airconditioning	3
4	Sheen Cuaderno	Male	26	Sr. Project Engineer	Daikin Airconditioning	2
5	Iza Marie Gabatin	Female	29	Property Manager	KMC Savills	3
6	Kheynel Balucan	Male	34	Construction Manager	Design Coordinates	7
7	Allen Joshua Padua	Male	29	Project Manager	Daikin Airconditioning	4
8	Gelvin Manalo	Male	31	Construction Manager	TransAsia	7

Note: All participants consented to be identified and agreed to participate in the study. Ethical guidelines were strictly adhered to protect their rights. The researchers ensured transparency and respect for participants throughout the observation and analysis process.

3.2 Measures

Data were gathered through semi-structured in-depth interviews (IDIs). The questions were designed to understand the reasons behind Filipino site workers' non-compliance with wearing hard hats. The interviews for project managers and safety officers focused on five key areas: (1) reasons for hard hat removal or improper use, (2) existing safety enforcement practices, (3) design issues with hard hats, (4) safety impacts of falling or loose hard hats, and (5) openness to using technological accessories such as an anti-strip belt. For site workers, the questions focused on similar areas: (1) reasons for not wearing hard hats, (2) comfort and usability during long work hours, (3) awareness of safety rules, (4) behavior towards supervision, and (5) willingness to adopt a safety accessory. These questions were grouped into three main analytical categories: (1) behavioral factors, which explored worker attitudes, habits, and awareness toward safety; (2) design and comfort factors, which examined the physical aspects of hard hats that affect compliance; and (3) technological and management factors, which assessed existing safety policies and openness to new interventions.

Table 2. General information about site workers

No	Name	Particulars				
		Gender	Age	Professional Title	Company	Years in the Company
1	Joseph Rey Del Rosario	Male	40	Site Supervisor	Daikin Airconditioning	4
2	Ian Pinon	Male	26	Site Engineer	Daikin Airconditioning	1.5
3	Eduardo Dono	Male	35	Site Engineer	Daikin Airconditioning	1
4	Earl Christian Bagonon	Male	27	Site Technician	Daikin Airconditioning	1
5	Dennis F Isuga	Male	50	Site Technician	Daikin Airconditioning	7
6	John Robles	Male	25	Site Engineer	Daikin Airconditioning	1
7	Rommel Ramos	Male	34	Site Engineer	Daikin Airconditioning	2
8	Jorge Penular	Male	26	Site Engineer	Daikin Airconditioning	1

Note: All participants consented to be identified and agreed to participate in the study. Ethical guidelines were strictly adhered to protect their rights. The researchers ensured transparency and respect for participants throughout the observation and analysis process.

4. Data Collection

Data were gathered through in-depth interviews with seven project managers, one safety officer, and eight site workers. The interviews were conducted face-to-face and through Microsoft Teams online meetings. The researcher recorded the interviews using a smartphone for in-person sessions and MS Teams' recording feature for online sessions. The audio recordings were then converted into text using NoteGPT and UniScribe. According to (Baruch et al. 2023), transcription methods can affect the accuracy, quality, and credibility of qualitative research, so the transcripts were reviewed to ensure correctness. For data analysis, the researcher followed the six steps of systematic thematic analysis (Naeem et al. 2023) to identify and interpret recurring patterns and themes. After coding the data, similar ideas were grouped into common themes, which were later combined into major themes. This process led to a clear and organized interpretation of the data, allowing meaningful insights to emerge.

4.1 Data Analysis

The collected data were analyzed using the six steps of systematic thematic analysis introduced by Naeem et al. (2023): (1) familiarization with data through repeated reading of transcripts, (2) generation of initial codes, (3) searching for emerging themes, (4) reviewing and refining themes, (5) defining and naming themes as shown in Table 3, Table 4 and Table 5, and (6) producing the final thematic report. To ensure trustworthiness, the researcher applied credibility through careful transcription and participant confirmation of responses, dependability by following a clear analysis process, confirmability through unbiased interpretation and citation of direct quotes, and transferability by providing detailed descriptions of participants and context for possible use in similar studies (Figure 1).

Table 3. Project Managers/Safety Officers Thematic Analysis, using the six steps of systematic thematic analysis introduced by Naeem et al. (2023)

Major Themes	Sub-Themes	Supporting Quotes from Participants
1. Environmental & Personal Discomfort	Heat and Humidity	“It is hot, so when workers feel they are safe, they remove their hard hats.” (Ms. Gabatin – Asst. Property Manager)
	Uncomfortable Chin Strap	“The chin strap sometimes causes itching and tightness around the neck; that is why they do not use it.” (Mr. De Guzman – Asst. Manager Consultant)
	Physical Fatigue / Heavy on Head	“It feels heavy on the head, especially when worn for long periods.” (Mr. Cuaderno – Project Manager)
2. Poor Design & Equipment Quality	Ill-Fitted Hard Hats	“The issued hard hats do not fit all workers properly.” (Ms. Gabatin - Asst. Property Manager)
	Low-Quality / Cheap Materials	“When the hard hat is cheaply made, it easily breaks, it is thin and not safe.” (Mr. De Guzman - Asst. Manager Consultant)
	Worn-Out or Old PPE	“After long use, the plastic becomes brittle.” (Ms. Gabatin - Asst. Property Manager)
3. Complacency & Behavioral Attitude	Overconfidence / Experience-Based Neglect	“I have been doing this for a long time, do I still need a hard hat?” (Mr. Gabatin – Safety Officer)
	Only Worn When Monitored	“When the safety officer sees them, they wear it. But once he has gone, they remove it again.” (Mr. Tejadilla – Project Manager)
	Normalization of Non-Compliance	“Some workers are really hard-headed even if they know the rules.” (Mr. Gabatin – Safety Officer)
4. Lack of Strict Enforcement & Monitoring	Reliance on Site Rounds	“For now, it is really just monitoring — the safety officer checks during site rounds.” (Mr. Cuaderno – Project Manager)
	Absence of Penalty / Weak Policy Implementation	“There is no other way except to double-check them personally.” (Mr. Cuaderno – Project Manager)
	Checklist and Administrative Control	“It is included in the PPE checklist, but not always followed.” (Mr. Gabatin – Safety Officer)
5. Safety Risk & Consequences Awareness	Falling Debris Risk	“If a hard hat falls off and something drops from above, that could cause a major accident.” (Mr. Tejadilla – Project Manager)
	Head Injuries from Low Clearances	“Sometimes you do not notice and suddenly bump your head in tight spaces.” (Mr. Cuaderno – Project Manager)
	Unpredictable Nature of Hazards	“We do not know when accidents might happen, so we should always wear it.” (Mr. Tejadilla – Project Manager)
6. Openness to Technological & Design Solutions	Anti-Strip Belt Acceptance	“It is a good idea to try it so we can monitor who removes their hard hats.” (Mr. Tejadilla – Project Manager)
	Perception of Dual Benefit	“It is multipurpose — for the safety of both the workers and management.” (Mr. Cuaderno – Project Manager)

	Motivation to Improve Compliance	“If there is an anti-strip belt, workers will become more disciplined.” (Mr. Gabatin – Safety Officer)
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Table 4. Sites Workers Thematic Analysis, using the six steps of systematic thematic analysis introduced by Naeem et al. (2023)

Major Theme	Sub-Theme	Supporting Quotes
1. Physical Discomfort and Environmental Factors	Heat and humidity at the worksite	“When you work long hours, it becomes irritating because of the heat.” – (Mr. Del Rosario – Site Supervisor)
	Weight and pressure of the hard hat	“It is heavy on the head, especially when it is hot, and you are already tired.” – (Mr. Pinon – Site Engineer)
	Strap irritation and skin discomfort	“The strap gets stuck on the skin when used for a long time, and it is itchy.” – (Mr. Isuga – Site Technician)
2. Equipment Design and Comfort Issues	Poor ventilation and fit	“If the hard hat is too tight, it hurts. If loose, it keeps moving.” – (Mr. Dono – Site Engineer)
	Need for better ergonomic design.	“Maybe it is better to test new designs like the anti-strip belt for more comfort.” – (Mr. Del Rosario – Site Supervisor)
3. Lack of Training and Safety Awareness	Absence of proper safety orientation	“Sometimes when entering the site, there is no safety orientation, especially for new hires.” – (Mr. Dono – Site Engineer)
	Insufficient knowledge of company policies	“Many companies do not emphasize safety compliance or discuss policies well.” – (Mr. Robles – Site Engineer)
	Low prioritization of safety over work and income	“Most workers just focus on earning money; they disregard safety.” – (Mr. Pinon – Site Engineer)
4. Organizational and Supervisory Influence	Compliance only when supervised	“Workers wear hard hats only when the supervisor is watching to avoid penalties.” – (Mr. Bagonon – Site Technician)
	Fear of penalties or suspension	“They wear it because they do not want to get scolded or suspended.” – (Mr. Ramos – Site Engineer)
	Lack of consistent enforcement	“Some companies are strict, others are not, so compliance changes.” – (Mr. Isuga – Site Technician)
5. Technological Solutions and Innovation Acceptance	Openness to innovative safety technology	“It is good to try the anti-strip belt to ensure workers always wear their hard hats.” – (Mr. Penular – Site Engineer)
	Belief that innovation can improve compliance	“The device can help monitor workers and improve compliance on site.” – (Mr. Dono – Site Engineer)
	Perceived mutual benefit for management and workers	“It is a win-win, for management and workers, ensuring everyone’s safety.” – (Mr. Bagonon – Site Technician)

Table 5. Combined Thematic Analysis, using the six steps of systematic thematic analysis introduced by Naeem et al. (2023).

Major Themes	Sub-Themes	Supporting Quotes (Project Managers & Site Workers)
1. Environmental and Physical Discomfort	Heat and humidity Heavy and tight-fitting helmets Strap irritation and sweating	“It is hot, so when workers feel they are safe, they remove their hard hats.” (Asst. Property Manager) “It feels heavy on the head, especially when worn for long periods.” (Project Engineer) “The strap gets stuck on the skin when used for a long time, and it is itchy.” (Site Technician)
2. Poor Design and Equipment Quality	Ill-fitting and poor ventilation Cheap or low-quality materials Worn-out PPE	“The issued hard hats do not fit all workers properly.” (Asst. Property Manager) “Cheap hard hats easily break and are unsafe.” (Safety Officer) “If the hard hat is too tight, it hurts; if loose, it keeps moving.” (Site Engineer)
3. Lack of Training and Safety Awareness	No safety orientation or refresher training Low awareness of company policies Focus on income over safety.	“Sometimes when entering the site, there is no safety orientation, especially for new hires.” (Site Engineer) “Many companies do not emphasize safety compliance.” (Site Engineer) “Most workers just focus on earning money and disregard safety.” (Site Technician)
4. Behavioral and Cultural Factors	Overconfidence from experience Normalization of non-compliance Only compliant under supervision	“I have been doing this for a long time—do I still need a hard hat?” (Safety Officer) “When the safety officer sees them, they wear it. But once he has gone, they remove it again.” (Project Manager) “Workers wear hard hats only when the supervisor is watching to avoid penalties.” (Service Technician)
5. Weak Enforcement and Organizational Governance	Reliance on monitoring rounds Absence of consistent penalty or policy enforcement Uneven safety implementation across projects	“For now, it is really just monitoring, the safety officer checks during site rounds.” (Project Manager) “Some companies are strict, others are not, so compliance changes.” (Service Technician) “There is no other way except to double-check them personally.” (Project Manager)
6. Safety Consequences and Risk Awareness	Head injuries from falling objects Unexpected site hazards	“If a hard hat falls off and something drops from above, that could cause a major accident.” (Project Manager) “Sometimes you bump your head in tight spaces.” (Project Engineer)

	Work stoppage and cost implications	“Injury can lead to stop work and penalties, affecting schedule and cost.” (Project Manager)
7. Openness to Technological Innovation	Acceptance of the anti-strip belt. Belief in improved monitoring and discipline. Perceived mutual benefit for safety and management.	“It is a good idea to try it so we can monitor who removes their hard hats.” (Project Manager) “It is multipurpose, for the safety of both the workers and management.” (Project Engineer) “It is a win-win, ensuring safety for both management and workers.” (Service Technician)

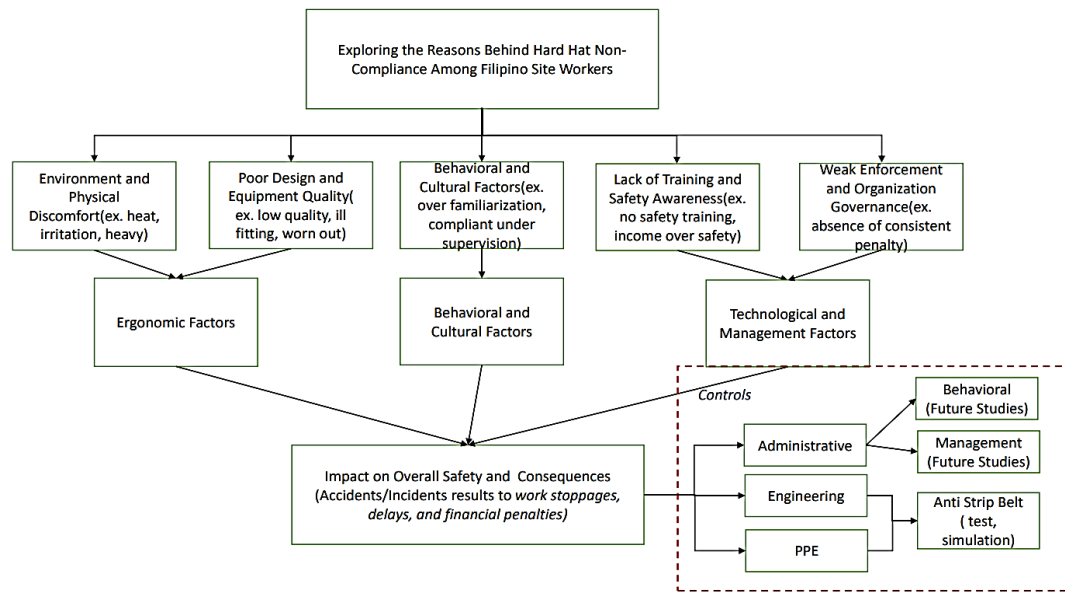


Figure 1. Conceptual model diagram that visually represents the combined thematic framework (showing causes, effects, and mitigating innovation)

5. Results and Discussion

The discussion centers on identifying the reasons why Filipino site workers do not consistently wear their hard hats. It focuses on three main areas: ergonomic factors, such as discomfort, poor fit, and heat; behavioral factors, including weak safety habits, inadequate training, and dependence on supervision; and management and technological factors, including limited policy enforcement and a lack of innovative safety solutions.

5.1 Common reasons why site workers removed or did not properly wear hard hats

Based on the thematic analysis following the six-step approach of Naeem et al. (2023), the main reasons for hard hat non-compliance among Filipino site workers are categorized into three key factors: ergonomic, behavioral, and technological and management factors. The most prominent cause is related to ergonomic factors, where workers report physical discomfort such as heat, sweating, heaviness, and strap irritation as major reasons for removing their hard hats. These findings support earlier studies, which have shown that discomfort and poor ergonomic design often lead to the avoidance of personal protective equipment (PPE) among construction workers (Jitwasinkul & Hadikusumo, 2011). Additionally, poor equipment design and the use of low-quality materials, including ill-fitting or reused hard hats, further exacerbate non-compliance, especially when safety gear is procured from low-cost suppliers. Behavioral factors also contribute to the problem. Many workers develop a sense of overconfidence and complacency, believing they are “experienced enough” to judge safety risks, which leads them to neglect wearing hard hats (Adade-Boateng et al. 2021). Lastly, technological and management factors, such as weak enforcement of safety policies, limited monitoring, and a lack of innovative safety solutions, contribute to reduced compliance on-site. These

combined factors underscore the need for enhanced safety management and the integration of engineering controls, such as the proposed Anti-Strip Belt technology, to ensure consistent PPE use and mitigate safety risks.

5.2 Impacts of PPE Non-Compliance in the Philippine Context

The thematic data showed that non-compliance contributed directly to increased vulnerability to head injuries, especially from falling debris or sudden impacts. Several participants described instances where loose or absent helmets heightened the severity of minor site accidents, echoing findings from (Lingard and Rowlinson 2004), who emphasized that lapses in PPE compromise both personal and collective site safety. Additionally, project managers reported that such incidents could trigger *work stoppages, delays, and financial penalties*, illustrating how individual non-compliance can escalate into systemic operational and economic consequences. The perception of a hard hat used as merely a “formality” rather than a life-saving precaution highlighted an urgent need for cultural and administrative reinforcement of safety protocols.

5.3 Anti-Strip Belt Technology for Hard Hat

Thematic convergence demonstrated strong participant openness to adopting such innovations, viewing them as a “win-win” solution that supports both workers’ safety and management’s compliance goals. An anti-strip belt technology, as shown in Figure 2, is a safety monitoring technology integrated into the hard-hat chin strap. The chin strap is equipped with a sensor that detects whether it is properly latched or unlatched. When the strap status changes, the sensor transmits a signal to a repeater, which amplifies and forwards the signal to a central console. The console display, located in the security or safety officer’s control room, provides real-time identification of workers who remove or improperly wear their hard hats.

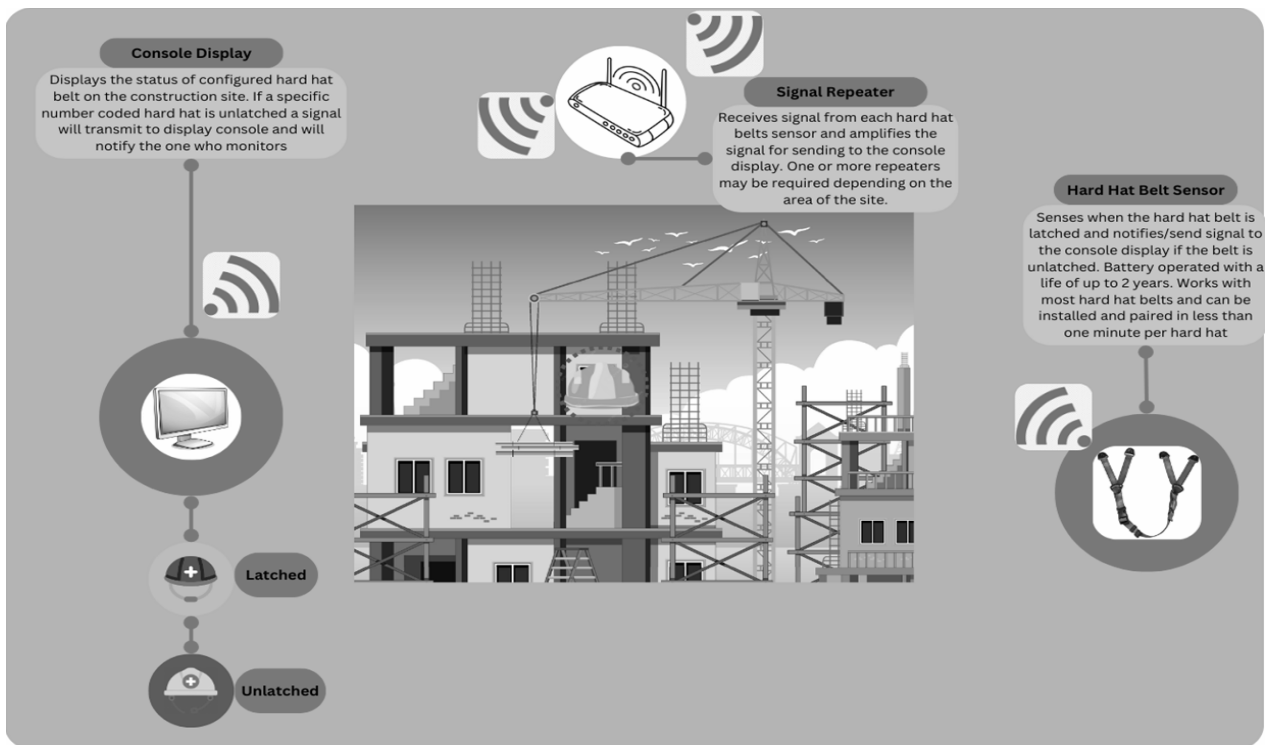


Figure 2. Anti-strip belt technology for Hard-hat conceptual design

5.4 Limitations and Cautions

The recommendations were drawn from qualitative in-depth interviews with a limited number of participants; therefore, the results should be interpreted with caution. To make the study more reliable and well-supported, it was suggested to include a larger sample in future research, involving other groups such as (1) the academe, (2) PPE suppliers, and (3) electronics engineers. The researcher also recommended that future studies use a mixed-method

approach or conduct pilot testing to further validate the findings. Future studies may focus on the behavior and safety habits of workers before entering the site, as these actions can influence their compliance with safety rules once on-site (Liu et al. 2025).

6. Conclusion

The thematic analysis showed that hard hat non-compliance was mainly influenced by three major factors: (1) behavioral factors, which involved worker attitudes, habits, and awareness toward safety; (2) design and comfort factors, which focused on the physical features of hard hats that affected comfort and proper use; and (3) technological and management factors, which related to existing safety policies, supervision practices, and openness to new safety innovations. These combined issues led to frequent hard-hat removal, an increased risk of head injuries, and operational disruptions, such as work stoppages and penalties. The study proposed the use of *an anti-strip belt as an engineering control to improve hard hat retention and support passive safety monitoring. This innovation aimed to directly address the key causes of non-compliance and enhance overall site safety.* The findings carried important implications for several areas. For engineering design, they underscored the need for ergonomic and user-centered PPE solutions. For management policy, they emphasized consistent implementation of safety rules and data-based monitoring systems. For safety training, they emphasized the importance of enhancing worker awareness and cultivating long-term safety habits. As a next step, the researcher recommended prototyping and field testing the proposed anti-strip belt to evaluate its comfort, durability, and real-world effectiveness. This validation process would help ensure that the design not only meets technical standards but also supports behavioral change and strengthens safety compliance across construction sites.

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Declaration of Conflict of Interest and Declaration of the Use of AI

The authors confirm no conflicts of interest related to this manuscript. The authors confirm that no generative AI or AI technologies were used to develop ideas, though AI was employed to improve readability and language. Afterward, the text underwent thorough human editing and review to ensure accuracy and organization.

Authorship Contribution Statement

Joshua Elydor Butaslac authored the paper and conducted the In-depth Interviews. Jaypy Tenerife provided expert guidance throughout the study, drawing on his expertise in qualitative research methods. He also reviewed and edited the manuscript for publication.

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