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Barriers to Incident Reporting in the Pakistani Construction Industry: An Exploratory Factor Analysis Approach

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Abstract: The construction industry is among the most hazardous industries, with workers routinely involved in critical accidents. Following proper safety procedures can help reduce these accidents. Incident reporting is widely regarded as an effective approach to improving worker safety on construction sites, as it allows relevant stakeholders to learn from past events. Despite the acknowledged significance of incident reporting in reducing accident rates, several researchers have reported that the construction industry still lacks effective reporting and investigation practices. This study aims to explore the barriers that inhibit the reporting of incidents in the Pakistani construction industry. Through a detailed literature review, 29 barriers that inhibit effective incident reporting were identified. A questionnaire survey was then carried out to include the perspective of construction industry professionals on the identified barriers. A total of 214 responses were collected. Further, for dimension reduction, exploratory factor analysis (EFA) was utilised and resultantly, four components were revealed and discussed. These components include organisational, individual, environmental and technical. The findings of this study will help the relevant stakeholders in the construction industry improve safety performance by mitigating these reporting challenges at the construction sites, resulting in a better working environment for workers with fewer risks and accidents.

Keywords: Barrier identification and mitigation, Incident reporting, Pakistani construction industry, Exploratory factor analysis, Workplace safety

INTRODUCTION

Safety records of the construction industry indicate poor performance worldwide owing to recurring accidents involving near-misses, work-induced health issues, injuries and fatalities (Choudhry and Zahoor, 2016; Chigara and Moyo, 2022). Workplace safety has become a prominent issue for many organisations due to the consequences of an unsafe environment, which affect productivity and harm the health of the workforce (Singh and Misra, 2021). According to the International Labour Organization (2018), each year, approximately 2.78 million people lose their lives due to work-related accidents and occupational diseases across the globe. Moreover, it has been estimated that the number of incidents and illnesses per year is 374 million, which results in employees being absent from work for extended durations (International Labour Organization, 2018). The situation is particularly severe in the construction industry, where accidents occur at a substantially

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higher rate than in other industries (Singh and Misra, 2021). The findings of Umar (2019) highlighted that accidents are caused by a variety of reasons, including the unique nature of the construction industry, inadequate understanding of safety regulations, failure to implement safety protocols, recruiting unskilled employees, construction machinery or equipment failure, stress, including physical and emotional and reckless human behaviours. The causes of accidents in the construction industry have remained a popular topic for researchers working in the domain of construction management. One possible explanation for this growing trend in research is that this realm is perceived to significantly impact the reduction of accidents, based on which the management develops effective strategies on how to avoid the reoccurrence of accidents in their future projects (Umar, 2019). To establish an accident prevention strategy for a construction project, it is required to first understand the prevailing underlying root causes of existing incidents and accidents (Cermelli et al., 2019). Effective safety management is based on feedback from field experiences, a process by which knowledge about the consequences of an action is communicated back to policymakers as new input to change and improve subsequent operations (Sandberg and Albrechtsen, 2018). In addition, it is believed that paying attention to the underlying factors will be required for long-term improvements in sustainable construction practises (Al-Aubaidy, Caldas and Mulva, 2022).

The approach of incident reporting has been extensively employed in various sectors, such as nuclear energy, aviation and the petrochemical industry. These sectors have developed a tradition of effective safety management, with numerous incident reporting systems established for advanced reporting of critical incidents (Jones, Kirchsteiger and Bjerke, 1999; Saurin et al., 2015). Moreover, literature has also highlighted successful incident-reporting initiatives in other industries, including construction and healthcare (Cambraia, Saurin and Formoso, 2010; Saurin et al., 2015; De Silva, Rathnayake and Kulasekera, 2018). These reporting systems are intended to gather, process and distribute data from a wide variety of safety-related incidents, particularly those regarded as precursors to accidents, such as near-misses (Reason, 2016). The data collected helps in identifying the root causes of incidents and consequently strengthening the safety culture by taking necessary preventive measures (De Silva, Rathnayake and Kulasekera, 2018).

Incident reporting within an organisation is the first step towards learning and critical analysis of events, ensuring that all necessary safety measures are in place to prevent their reoccurrence (Chigara and Moyo, 2022). Despite the acknowledged benefits of incident reporting in successfully eliminating the rate of critical occurrences, the under-reporting phenomenon has been amply highlighted in the empirical literature (Probst and Estrada, 2010; Probst and Graso, 2013; De Silva, Rathnayake and Kulasekera, 2018; Al-Aubaidy, Caldas and Mulva, 2022). It has been found that organisations with unsatisfactory safety culture failed to report more than 80% of accidents to the Occupational Safety and Health Administration (OSHA), whereas companies with a favourable safety environment failed to report 47% of such incidents in the United States of America (USA) (Naji et al., 2021). Similarly, it has also been reported that employees failed to report over half of all experienced accidents to their supervisors (De Silva, Rathnayake and Kulasekera, 2018). The under-reporting phenomenon is far worse in developing countries, where incident reporting in the construction industry is not taken seriously even though occupational exposure to hazards is very high. Most of the tasks are

performed manually and record-keeping is of poor quality when measured against international standards (Abukhashabah, Summan and Balkhyour, 2020).

The investigation of the barriers that potentially inhibit the reporting of safety incidents in an organisation is crucial for the successful implementation of safe working environments. Various studies have already established the importance of incident reporting systems to improve worker safety and the need to understand the resistance of potential users (Al-Rayes et al., 2020; Maslen et al., 2020; Alrub et al., 2022). However, the theoretical explanation of end-users' resistance towards effective incident reporting in the construction industry of developing countries is in dire need of further exploration. To fill this research gap, the present study aims to explore and identify the barriers inhibiting the effective reporting of incidents at construction sites in the context of developing countries like Pakistan and to determine whether the identified barriers may be further classified into closely related components. The following research question will be investigated in this study: What are the primary barriers inhibiting the efficient usage of incident reporting systems at construction sites in developing countries? The outcomes of this study will guide the relevant stakeholders in taking necessary actions to mitigate the barriers to the effective reporting of incidents.

CONSTRUCTION INDUSTRY IN PAKISTAN

The construction industry in Pakistan has experienced rapid growth in the past decade, mainly attributable to the democratic setup and consistent government policies (Hasnain et al., 2018). However, compared to developed countries, such as the USA, the construction practices in Pakistan are deemed more labour-intensive (Choudhry and Zahoor, 2016; Khan et al., 2019). Fluctuations in demand, the project base of construction and the widespread use of multi-level sub-contracting arrangements all conspire to make it difficult for construction labours to get a consistent flow of work that would allow them to provide continuity of employment (Kanaganayagam, Ogunlana and Fung, 2013). Consequently, with rising inflation and poor economic conditions, workers migrate within the country for better employment opportunities, thus forming a mix of diverse groups at construction sites with different languages and cultural backgrounds. Excavation labour is often supplied from the province of Khyber-Pakhtunkhwa, concrete labourers from the Punjab province and carpenters from the Kashmir region (Choudhry and Zahoor, 2016). Since the construction sector is in the developing stage it requires the adoption of several standard practices to compete with the international market. In Pakistan, the prevailing occupational health and safety standards are regulated by the Factories Act of 1934, the Minimum Wage Ordinance of 1961 and the Workmen's Compensation Act of 1923 (Choudhry and Zahoor, 2016; Raheem and Issa, 2016). These state laws, which are not specific to the construction sector, are primarily concerned with the occupational health and safety of factory workers (Memon et al., 2017). Subsequently, the magnitude and severity of accidents emerging on construction sites are rising at an alarming rate. The accurate documentation of incidents is deemed challenging due to insufficient reporting and further manipulation of work-related accidents and illnesses (Saqib et al., 2023). However, the Pakistan Bureau of Statistics (2017–2018) reported that construction injuries and fatalities accounted for around 17.27% of total labour force injuries and fatalities, although construction workers comprise only 7.61% of

the overall labour force (Pakistan Bureau of Labour Statistics, 2017). Raheem and Issa (2016) observed that the majority of construction accidents are not reported to the Labour Department due to a lack of enforcement of existing labour laws and seriousness on the part of the construction organisations in dealing with the grave health and safety situation. Typically, only casualties or dangerous occurrences that garner media attention are documented. As a result, it appears unlikely that accessible occupational health and safety data would be trustworthy (Raheem and Hinze, 2012; Raheem and Issa, 2016; Momeet et al., 2022).

The construction industry contributes significantly to the gross domestic product (GDP) in both developed and developing countries; however, the negative impact of occupational safety and health performance on the working population is quite evident (Singh and Misra, 2021). Organisations dealing with safety and health, such as HSE (UK), OSHA (USA) and Safe Work (Australia), play a substantial role in driving a country's safety and health performance. These administrations become the primary source of health and safety statistics reflecting the industry's safety record. However, there are no such organisations in developing countries like Pakistan. Even if such groups exist, they are either not fully functional or are not functioning properly, thus making it one of the most pressing issues in this region, as emphasised by Umar and Wamuziri (2016). The only regulating authority, the Pakistan Engineering Council (PEC), has yet to issue regulatory standards for construction industry stakeholders to comply with (Hasnain et al., 2018). Due to the presence of a weak administrative framework, the safety of workers is not the main objective of the construction industry (Raheem and Issa, 2016). Additionally, the private sector dominates the construction industry in Pakistan and due to inadequate technical and financial resources, poor working environments are quite prevalent (Hinze, Devenport and Giang, 2006; Ejaz et al., 2013; Farooq et al., 2022). Likewise, the construction industry of Pakistan has adopted a responsive strategy rather than a pre-emptive strategy toward the safety of millions of workers at construction sites (Khan et al., 2019).

This is not to imply that Pakistan is not advancing in the field of infrastructure development. The country is now witnessing enormous infrastructure growth, with various development projects ongoing and several projects in the planning phase. Example of these infrastructure projects includes buildings, motorways, highways, dams, underpasses, flyovers, water supply systems, interchanges and rapid mass transit systems (Hali, Shukui and Iqbal, 2015). Furthermore, the economic cooperation between China and Pakistan with Chinese investment in Pakistani infrastructural growth has further helped in bringing a new perspective to the Pakistani construction industry. These ventures provide Pakistan with a prospect for global recognition; however, concerns such as safety should first be addressed for the quality provision of construction projects (Khahro et al., 2021).

INCIDENT REPORTING AND RELATED BARRIERS

Incident reporting is defined as an approach to preventing future hazardous incidents and accidents by learning from past events (Rossignol, 2015). In almost all countries, employees are required to report work-related injuries to their employers, for recording and processing incidents with relevant government authorities (De Silva, Rathnayake and Kulasekera, 2018). According to the "iceberg principle" on the correlation between various types of accidents and near misses, for every major

accident that occurs, a large number of related minor injuries and near misses occur (De Silva, Rathnayake and Kulasekera, 2018). The benefits of collecting and analysing near-misses are explicit because they provide free lessons (Reason, 2016). If the appropriate conclusions are reached and followed, they can operate as "vaccinations" to stimulate the system's defence against a more significant event in the future and, just like effective vaccines, they are expected to do so without harming anything or anyone. Further, they offer qualitative acumen into how minor defensive deficiencies might pile up to cause huge tragedies (Stanton et al., 2009). Because they occur more frequently than adverse consequences, they provide the numbers needed for more in-depth quantitative evaluations. Moreover, they also serve as a strong warning of the system's flaws, slowing the process of acute calamity. As Gnoni and Saleh (2017) stated, learning from near-misses is less expensive than learning from well-grown more damaging analogues, such as accidents.

Several researchers have worked to mitigate the barriers to effective incident reporting. One of the challenges they observed with cognitive processing of accidents was that information might be filtered selectively before being transferred to higher echelons aimed at minimising liabilities and blame concerns. The attribution of responsibility to the reporter was also cited as a factor hindering the sharing of information in the filter model proposed for incident reporting (Webb et al., 1989). Similarly, Elwell (1995) argued that crew members of the flight might be too guilty to confess their faults or expect to be penalised, explaining his discovery that human errors, particularly when others have not noticed these, are misreported in aviation reporting systems. Likewise, in his discourse of factors that could stimulate individuals' adoption of their organisation's health and safety culture and hence the desire to give to the organisation's reporting system, O'Leary (1995) mentioned the fact that legal pronouncements have frequently ignored circumstances resulting in poor performance, that society puts pressure to level allegations and punishments, the military culture in the aviation industry and the fact that many pilots feel responsible or even guilty for incidents. In line with this, Bridges (2000) claimed that fear of punitive action and teasing by fellow employees are among the key reasons for poor reporting, based on survey results conducted among safety managerial staff of chemical process plants. Furthermore, the firm expresses concern about potential accountability if the reporting systems are manipulated by outsiders as a possible deterrent against reporting safety incidents. When this anxiety is communicated to the workers, whether explicitly or implicitly, their willingness to participate suffers badly (Bridges, 2000).

It has been discovered that mishaps might be viewed as "part of the job" due to their frequent occurrence and workers may have developed their interim guards against it (Powell, 1972). Moreover, according to Glendon (1991), the "macho" work climate observed in some industries, such as construction, impeded reporting. Dominant societal views on which certain dangerous occurrences are considered acceptable were also cited as an essential element in reporting behaviour (Webb et al., 1989).

Additionally, Beale, Leather and Cox (1994) indicated that management's alleged attitudes have a large impact on reporting levels, especially their lack of commitment to the reporting of safety incidents. In line with this, van der Schaaf, Lucas and Hale (1991) claimed that organisational safety culture and related management approaches influence the forms of near misses being reported. Chemical plant safety personnel cited a lack of management commitment and

an inability to follow through after incidents are reported as causes for inadequate reporting practices (Bridges, 2000). It is also found that people quickly become dissatisfied with incident reporting when they observe that management does not review and appreciate their reports; and that the reporting rate further suffers when those to whom one must report do not acknowledge the job of the people engaged in the occurrences (Powell, 1972). A recent study conducted in the Sri Lankan construction industry highlighted numerous organisational and individual barriers and stressed the need for training and resources for effective reporting of incidents (De Silva, Rathnayake and Kulasekera, 2018). Similarly, the latest research (Al-Aubaidy, Caldas and Mulva, 2022) identified various barriers, including fear of litigation, fear of negative publicity exposure, high insurance and other effects of internal and external behaviours and practices.

All the research studies mentioned above have assessed barriers to incident reporting in various regional settings and industry sectors; it is, therefore, vital to identify the barriers to effective incident reporting concerning the construction industry of Pakistan. This study's methodology is a quantitative research design, which will be detailed further in the subsequent section.

METHODS

This study employs a quantitative approach to determine the most crucial barriers/hindrances to effective incident reporting in the Pakistani construction industry. The research data was gathered in two stages: in the first stage, a detailed literature review was carried out followed by a survey questionnaire. At the literature review stage, the barriers influencing the effective reporting of incidents in the construction industry were identified. A systematic literature review process was undertaken to use articles with high quality and relevance to this study. The literature review was conducted using several search engines, including Google Scholar, Web of Science and the HEC Digital Library, which proved to be highly beneficial. As part of the initial search criteria, no restrictions on the year of publication were applied. The keywords used were: "Reporting barriers", "Reporting behaviour", "Reporting tendencies", "Reporting biases", "Near-miss report" and "Incident reporting". The search yielded 57 studies, which included journal articles, conference papers and reports. However, following the exclusion of irrelevant and low-quality studies, a set of 27 publications was chosen for barrier identification. The investigation of these research publications led to the identification of 29 barriers inhibiting the effective reporting of incidents (as shown in Table 1).

Table 1. List of variables affecting the incident reporting used in the questionnaire

Variable No.	Variable Name	References
BIR 01	Existence of strict disciplinary action	Mitropoulos, Abdelhamid and Howell (2005), Riege (2005), Saurin et al. (2015), Indrayana et al. (2020) and Alrub et al. (2022)

(*Continued on next page*)

Table 1. *Continued*

Variable No.	Variable Name	References
BIR 02	Acceptance of some hazards as part of routine work	O'Leary (1995), van der Schaaf and Kanse (2004), Haslam et al. (2005), Mitropoulos, Abdelhamid and Howell (2005), Sanne (2008) and Saurin et al. (2015)
BIR 03	Job insecurity and fear of job loss	Riege (2005), Storgård et al. (2012), Gnoni and Saleh (2017), Maslen et al. (2020), Umeokafor, Evangelinos and Windapo (2020) and Al-Aubaidy, Caldas and Mulva (2022)
BIR 04	Lack of management commitment to report incidents	Ortega (2000), van der Schaaf and Kanse (2004), Rossignol (2015) and Saqib et al. (2023)
BIR 05	Lack of trust in the anonymity of the reporting system	O'Leary (1995), Bridges (2000), Umeokafor, Evangelinos and Windapo (2020) and Alrub et al. (2022)
BIR 06	Lack of knowledge about reporting requirements	Mitropoulos, Abdelhamid and Howell (2005), Storgård et al. (2012), Gnoni and Saleh (2017) and Indrayana et al. (2020)
BIR 07	Focus on keeping the company's "accident-free record"	Pransky et al. (1999) and Azaroff, Levenstein and Wegman (2002)
BIR 08	Fear of separation from co-workers	Pransky et al. (1999), van der Schaaf and Kanse (2004) and Umeokafor, Evangelinos and Windapo (2020)
BIR 09	Incentives to achieve zero-accident targets	Probst and Graso (2013), Saurin et al. (2015), Gnoni and Saleh (2017), Sandberg and Albrechtsen (2018), Indrayana et al. (2020) and Al-Aubaidy, Caldas and Mulva (2022)
BIR 10	Reporting procedure is not appropriate and time-consuming	O'Leary (1995), Haslam et al. (2005), Mitropoulos, Abdelhamid and Howell (2005), Saurin et al. (2015), Oswald, Sherratt and Smith, (2018), Sandberg and Albrechtsen (2018) and Alrub et al. (2022)
BIR 11	Production pressure	Probst and Estrada (2010) and De Silva, Rathnayake and Kulasekera (2018)
BIR 12	Lack of feedback on how information reported has been used	Ortega (2000), Prang and Jelsness-Jørgensen (2014), Saurin et al. (2015), Umeokafor, Evangelinos and Windapo (2020) and Alrub et al. (2022)
BIR 13	Fear of legal consequences and investigations	Bridges (2000), Haslam et al. (2005), Mitropoulos, Abdelhamid and Howell (2005), Umeokafor, Evangelinos and Windapo (2020) and Al-Aubaidy, Caldas and Mulva (2022)

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Table 1. *Continued*

Variable No.	Variable Name	References
BIR 14	Fear of negative publicity exposure	Haslam et al. (2005) and Mitropoulos, Abdelhamid and Howell (2005)
BIR 15	Short-term contract engagement including subcontracting	Bridges (2000), Gnoni and Saleh (2017), Sandberg and Albrechtsen (2018) and Al-Aubaidy, Caldas and Mulva (2022)
BIR 16	Confusion regarding what is reportable	Elwell (1995) and Saurin et al. (2015)
BIR 17	Lack of training and instruction	Azaroff, Levenstein and Wegman (2002) and Lingard (2013)
BIR 18	Feelings of being misunderstood or undervalued	O'Leary (1995), van der Schaaf and Kanse (2004) and Riege (2005)
BIR 19	Resistance to future employment or career progression opportunities	Saurin et al. (2015) and Indrayana et al. (2020)
BIR 20	Fear of being assigned to lighter jobs that workers disliked	Azaroff, Levenstein and Wegman (2002) and Lingard (2013)
BIR 21	Insufficient information to complete the required formalities	Pransky et al. (1999), van der Schaaf and Kanse (2004) and Riege (2005)
BIR 22	Different cultural, ethnic and language background	O'Leary (1995) and Riege (2005)
BIR 23	Lack of safety communication in the organisation	Bridges (2000), Lingard (2013), Rossignol (2015), Sandberg and Albrechtsen (2018) and Al-Aubaidy, Caldas and Mulva (2022)
BIR 24	Considering reporting an incident a sign of weakness – Men's perspective	(Azaroff, Levenstein and Wegman (2002) and Lingard (2013)
BIR 25	Lack of rewards for effective reporting of incidents	Ortega (2000), van der Schaaf and Kanse (2004), Lingard (2013) and Saqib et al. (2023)
BIR 26	High insurance costs	Mitropoulos, Abdelhamid and Howell (2005), Gnoni and Saleh (2017) and Al-Aubaidy, Caldas and Mulva (2022)
BIR 27	Fear of teasing by co-workers	Elwell (1995) and Bridges (2000)
BIR 28	Unwarranted surveillance	Elwell (1995) and Lingard (2013)
BIR 29	Individuals wish not to appear incompetent	Bridges (2000)

Based on the barriers identified, a questionnaire was developed and distributed to consultants, project managers, employers and contractors actively involved in the construction practices to include input based on their experience. The questionnaire was divided into three sections. In the first section, gratitude

was expressed for the participants' willingness to take part in the experiment and information about the study was briefly presented. The respondents were ensured that personal details would be kept in the strictest confidence and individual names or job descriptions would not be disclosed in the study. The second section asked demographic-related questions regarding participants' age, work sector, education level and work experience. In the third section, respondents were asked to rate the influence of identified barriers. A five-point Likert-type scale anchored from 1 = "Not influential at all" to 5 = "Very influential" was used in the questionnaire. The study targeted experts working in diverse domains including clients, contractors and consultants through online means whereby a questionnaire was sent to them in English. Professionals were identified via simple random sampling. Moreover, there are no limitations on the size or type of construction organisation. A total of 214 survey responses were gathered. Among these responses, only 197 were found suitable, whereas the remaining 17 were excluded due to incomplete or repetitive response patterns. 92% of the responses (197/214) were eligible for further analysis. The demographic profile of the study respondents is shown in Table 2. A total of 83% of the respondents had more than six years of work experience; the majority of the respondents (49%) had bachelor's degrees and around 53% of respondents were from the private sector.

Table 2. Respondents' demographic characteristics

Variables	**Frequency**	**%**
Gender		
Male	168	85.3
Female	29	14.7
Age Group		
20 years old to 29 years old	45	22.8
30 years old to 39 years old	62	31.5
40 years old to 49 years old	76	38.6
50 years old and above	14	7.1
Education Level		
Diploma	35	17.7
Bachelors	97	49.3
Masters	54	27.4
Doctorate (PhD)	11	5.6
Work Experience		
1 year to 5 years	34	17.3
6 years to 15 years	65	33.0
16 years to 25 years	59	30.0
> 25 years	39	19.7

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Table 2. *Continued*

Variables	Frequency	%
Work Sector		
Public	73	37.1
Private	105	53.3
Others	19	9.6

STATISTICAL DATA ANALYSIS

To summarise the number of barriers inhibiting the effective reporting of safety incidents in the Pakistani construction industry and to extract the related components, the statistical technique of exploratory factor analysis (EFA) had been used. Employing EFA reduces the size of a data set to improve interpretability and uncover hidden data structures while maintaining the highest amount of original information (Mosly, 2020). When a scholar is uncertain about which, or how many, latent constructs can explain the initial collection of data, the term "exploratory factor analysis" is employed (Hinton, McMurray and Brownlow, 2014). Statistical Package for the Social Sciences (SPSS) version 26 was used to perform the analysis. To check the internal consistency of the responses obtained through the questionnaire survey, Cronbach's coefficient alpha method was adopted. The recommended threshold value of Cronbach's alpha must be greater than 0.7 to be considered acceptable (Cronbach, 1951). The collected data had a value of 0.912, which indicated the data was reliable and consistent. Before running the EFA, two key tests were performed: the Kaiser–Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity as indicated in Table 3. The value for KMO is 0.873, which is well above the recommended threshold of 0.5 (Babalola and Harinarain, 2021). Furthermore, Bartlett's test of sphericity was also observed to be 2737.429, with a significance level of 0.000. Hence, indicating the suitability of data for further factor analysis.

Table 3. KMO and Bartlett's test

KMO and Bartlett's Test		
KMO measure of sampling adequacy		0.873
Bartlett's test of sphericity	Approx. chi-square	2,737.429
	df	406
	Sig.	0.000

The commonality of the variables post-extraction can be observed in Table 4, demonstrating that none of the retrieved items has eigenvalues below the cut-off mark of 0.50, confirming that all variables are eligible for further analysis and processing (Babalola and Harinarain, 2021).

Table 4. Communalities

Communalities		**Initial**	**Extraction**
BIR 1	Existence of strict disciplinary action	1.000	0.806
BIR 2	Acceptance of some hazards as part of routine work	1.000	0.810
BIR 3	Job insecurity and fear of job loss	1.000	0.699
BIR 4	Lack of management commitment to report incidents	1.000	0.775
BIR 5	Lack of trust in the anonymity of the reporting system	1.000	0.792
BIR 06	Lack of knowledge about reporting requirements	1.000	0.743
BIR 07	Focus on keeping the company's "accident-free record"	1.000	0.778
BIR 08	Fear of separation from co-workers	1.000	0.844
BIR 09	Incentives to achieve zero-accident targets	1.000	0.565
BIR 10	Reporting procedure is not appropriate and time-consuming	1.000	0.786
BIR 11	Production pressure	1.000	0.798
BIR 12	Lack of feedback on how information reported has been used	1.000	0.722
BIR 13	Legal consequences and investigations	1.000	0.760
BIR 14	Fear of negative publicity exposure	1.000	0.561
BIR 15	Short-term contract engagement including subcontracting	1.000	0.681
BIR 16	Confusion regarding what is reportable	1.000	0.879
BIR 17	Lack of training and instruction	1.000	0.810
BIR 18	Feelings of being misunderstood or undervalued	1.000	0.833
BIR 19	Resistance to future employment or career progression opportunities	1.000	0.800
BIR 20	Fear of being assigned to lighter jobs that workers disliked	1.000	0.853
BIR 21	Insufficient information to complete the required formalities	1.000	0.859
BIR 22	Different cultural, ethnic and language background	1.000	0.827
BIR 23	Lack of safety communication in the organisation	1.000	0.694
BIR 24	Considering reporting an incident a sign of weakness – Men's perspective	1.000	0.779
BIR 25	Lack of rewards for effective reporting of incidents	1.000	0.718
BIR 26	High insurance costs	1.000	0.638
BIR 27	Fear of teasing by co-workers	1.000	0.743
BIR 28	Unwarranted surveillance	1.000	0.794
BIR 29	Individuals wish not to appear incompetent	1.000	0.798

Note: Extraction method: Principal component analysis.

Principal component analysis with varimax rotation was used to extract the components. This strategy can aid in the formation of a simple structure by reducing the likelihood of a "general" component in the solution (Chan, 2012). The number of factors to be extracted from the data set was calculated using Eigenvalues ≥ 1 and an absolute factor loading value ≥ 0.6 (Jadidoleslami, Saghatforoush and Ravasan, 2021). The variables demonstrating cross-loading capabilities, however, were removed from further analysis because they are not uniquely identified under a noted component.

DISCUSSION

EFA formed four components that emerged as dominating factors inhibiting the effective reporting of incidents at construction sites in Pakistan. A total of 68.15% of the total variation was explained by this four-factor component solution. The first component accounted for 29.92% of the total variance, whereas the second component accounted for 18.12% variance. Moreover, the third and fourth components explained 10.64% and 9.46% variance, respectively. The results can be seen in Table 5. The total variation explained is greater than the minimum suggested percentage of 50% (Pallant, 2013; Babalola and Harinarain, 2021). Finally, the components have been given short labels to reflect the correlation of all the variables contained within. Referring to the opinions of the academic experts, the labels assigned to the four components were as: organisational, individual, environmental and technical (the final results with specified labels are shown in Table 6).

Table 5. Summary of EFA results

Variables	Component			
	1	2	3	4
Lack of management commitment to report incidents	0.87			
Lack of feedback on how information reported has been used	0.85			
Existence of strict disciplinary action	0.83			
Lack of safety communication in the organisation	0.79			
Focus on keeping the company's "accident-free record"	0.75			
Lack of training and instruction	0.71			
Resistance in future employment or career progression opportunities	0.68			
Lack of rewards for effective reporting of incidents	0.65			
Unwarranted surveillance	0.62			
Acceptance of some hazards as part of routine work		0.83		
Job insecurity and fear of job loss		0.81		
Lack of knowledge about reporting requirements		0.75		
Fear of negative publicity exposure		0.72		

(*Continued on next page*)

Table 5. *Continued*

Variables	Component			
	1	2	3	4
Confusion regarding what is reportable		0.68		
Fear of separation from co-workers		0.66		
Feelings of being misunderstood or undervalued		0.65		
Fear of being assigned to lighter jobs that workers disliked		0.61		
Legal consequences and investigations			0.75	
Short-term contract engagement including subcontracting			0.74	
Incentives to achieve zero-accident targets			0.72	
Different cultural, ethnic and language background			0.67	
High insurance costs			0.63	
Production pressure			0.62	
Lack of trust in the anonymity of the reporting system				0.82
Reporting procedure is not appropriate and time-consuming				0.78
Insufficient information to complete the required formalities				0.71
% of variance	29.92	18.12	10.64	9.46
Cumulative %		48.05	58.69	68.15

Table 6. Extracted components and their related variables

Component Name	Variables
Organisational	Lack of management commitment to report incidents
	Lack of feedback on how information reported has been used
	Existence of strict disciplinary action
	Lack of safety communication in the organisation
	Focus on keeping the company's "accident-free record"
	Lack of training and instruction
	Resistance to future employment or career progression opportunities
	Lack of rewards for effective reporting of incidents
	Unwarranted surveillance

(*Continued on next page*)

Table 6. *Continued*

Component Name	Variables
Individual	Acceptance of some hazards as part of routine work
	Job insecurity and fear of job loss
	Lack of knowledge about reporting requirements
	Fear of negative publicity exposure
	Confusion regarding what is reportable
	Fear of separation from co-workers
	Feelings of being misunderstood or undervalued
	Fear of being assigned to lighter jobs that workers disliked
Environmental	Legal consequences and investigations
	Short-term contract engagement including subcontracting
	Incentives to achieve zero-accident targets
	Different cultural, ethnic and language background
	High insurance costs
	Production pressure
Technical	Lack of trust in the anonymity of the reporting system
	Reporting procedure is not appropriate and time-consuming
	Insufficient information to complete the required formalities

Component 1: Organisational

The nine barriers extracted for Component 1 were: "Lack of management commitment to report incidents" (87%), "Lack of feedback on how information reported has been used" (85%), "Existence of strict disciplinary action" (83%), "Lack of safety communication in the organisation" (79%), "Focus on keeping the company's 'accident-free record'" (75%), "Lack of training and instruction" (71%), "Resistance in future employment or career progression opportunities" (68%), "Lack of rewards for effective reporting of incidents" (65%) and "Unwarranted surveillance" (62%). The factor loadings are denoted by the numbers in parentheses. This component accounted for 29.92% of the total variance and is regarded as the most prominent of all four identified components. Resolving organisational barriers requires a shift in the existing methodologies and organisational culture and an understanding of the managerial capabilities concerning the issues of incident reporting at the organisational and project levels. As Wu et al. (2008) asserted, the management should strive to enact policies and incentives that positively inspire attitude towards the reporting of safety incidents to maintain favourable acceptance and use of the reporting systems in the industry. Additionally, several studies have highlighted the need for effective feedback on incident reports to motivate the user's participation in such incident reporting systems (Wu et al., 2008; Saurin et al., 2015; Alrub et al., 2022). For employees to continue to participate in the incident reporting process, they must see something positive coming out of it

(Saurin et al., 2015). The cluster of barriers reported in this component emphasises the need for organisations to take mitigating steps and inculcate confidence among the employees through effective policies and sound commitment toward the reporting culture. Management should also ensure that reporting should not have any negative consequences. Therefore, promoting a non-punitive reporting culture is a vital consideration for worker safety to eliminate the tendency of the under-reporting of incidents.

Component 2: Individual

The eight barriers extracted for Component 2 were: "Acceptance of some hazards as part of routine work" (83%), "Job insecurity and fear of job loss" (81%), "Lack of knowledge about reporting requirements" (75%), "Fear of negative publicity exposure" (72%), "Confusion regarding what is reportable" (68%), "Fear of separation from co-workers" (66%), "Feelings of being misunderstood or undervalued" (65%) and "Fear of being assigned to lighter jobs that workers disliked" (61%). The numbers in parentheses are the factor loadings. This component accounted for 18.12% of the total variance and is regarded as the second most prominent of all four identified components. The study conducted by De Silva, Rathnayake and Kulasekera (2018) reasoned that individuals sometimes make their judgment of the seriousness of an incident, which will then lead to their decision on whether or not to report it. Further, if they perceive that they were at fault too, then they are hesitant to report the incident (De Silva, Rathnayake and Kulasekera, 2018). Underreporting is encouraged further when individuals are apprehensive about the reporting procedures and perceive them to be risky and detrimental to their jobs. Therefore, as suggested by Su (2014), it is essential to consider the privacy requirements of the employees and to assure them that they will not face any penalty or retaliation from others as a result of incident reporting. The purpose of incident reporting should be to learn lessons and to prevent its reoccurrence instead of levelling allegations against human beings for their mistakes (Probst and Graso, 2013). It is thus vital for the management to promote the significance of incident reporting, as well as its key components, to enhance their level of knowledge and trust, which could lead to increased reporting in the future.

Component 3: Environmental

The six barriers extracted for Component 3 were: "Legal consequences and investigations" (75%), "Short-term contract engagement including subcontracting" (74%), "Incentives to achieve zero-accident targets" (72%), "Different cultural, ethnic and language backgrounds" (67%), "High insurance costs" (63%) and "Production pressure" (62%). The numbers in parentheses are the factor loadings and the component accounted for 10.64% of the total variance. Environmental factors are caused by significant environmental impacts, such as economic situations, technological developments, etc., that are beyond our control to a large extent (Jadidoleslami, Saghatforoush and Ravasan, 2021). Government policies also play a critical role in forming such environments. It has also been observed that these environmental barriers often overlap with managerial obstacles, indicating that focusing on enhancing management or changing managerial procedures can

provide appropriate direction for studies to identify solutions to these challenges (Jadidoleslami, Saghatforoush and Ravasan, 2021).

Component 4: Technical

The three barriers extracted for Component 4 were: "Lack of trust in the anonymity of the reporting system" (82%), "Reporting procedure is not appropriate and time-consuming" (78%) and "Insufficient information to complete the required formalities" (71%). The numbers in parentheses are the factor loadings and the component accounted for 9.46% of the total variance. The advancements in traditional reporting procedures and the shift towards electronic incident reporting practices have brought about significant complications in the reporting of safety incidents (Prang and Jelsness-Jørgensen, 2014). It is also observed that a lack of technical skill and knowledge further exacerbates the experience to a point where individuals no longer see the significance of the reporting process. Therefore, it is important to provide technical skills and basic computing training to workers lacking such resources and expertise, given that technological self-efficacy facilitates the use and adoption of reporting systems. Moreover, the concern of privacy has always dominated, and various measures have been taken to cater to this concern. Despite all these measures, individuals have shown a growing degree of dissatisfaction (Qureshi et al., 2021). It is suggested to ensure anonymity and confidentiality and to give confidence that reported information will not be used against them. The employees should be allowed to report the incident anonymously. When participants are more confident about using the system, the system is more likely to be accepted in the industry. In contrast, reporters may be less likely to report due to scarce trust and negative publicity by others (Wu et al., 2008). Decision-makers and technology staff should collaborate to identify and address users' needs and complaints to facilitate incident reporting. These aspects should be taken into account not only during the development phase but also during the implementation phase and even in the potential future upgradation of the system.

CONCLUSIONS

The barriers to successful incident reporting on construction sites are multifaceted, with various contributing factors for which stakeholders are to be blamed. Many studies have emphasised the importance of incident reporting, although little research has explored and discussed the potential barriers in the context of the Pakistani construction industry. This research concludes the barriers inhibiting the reporting of safety incidents in the construction industry of Pakistan. At first, using a systematic literature review, the list of barriers to incident reporting was advanced in the form of a questionnaire. Following that, a survey of construction industry professionals was carried out. The collected data was analysed using the EFA approach. The barriers identified were then classified into four clusters: organisational, individual, environmental and technical. It has been found that the most significant cluster hindering the successful incident reporting implementation in Pakistan is organisational-related barriers. The findings of this study contribute to the existing body of knowledge about the awareness and implementation of incident reporting practices and also provide a theoretical basis to take adequate

measures to encourage incident reporting in the construction sector of Pakistan and similar emerging construction industries, thereby providing a safer working environment for workers and reducing the likelihood of construction-related incidents.

Future research should concentrate on how the drivers of incident reporting can be harnessed to overcome the existing barriers, considering the conditions governing the Pakistani construction industry and applying expert perspectives. Researchers may also use qualitative research methods such as case studies in the future to study barriers to successful incident reporting implementation in similar or some other settings.

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