International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 5, 2025
https://theaspd.com/index.php

Behaviour-Based Safety: A Systematic Literature Review

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Abstract
Behavioural methods is a proactive way of improving work-related safety by identifying and modifying unsafe behaviours. The experiential base for behavioural safety continues to gain importance and guide practitioners and companies. This review article intends to highlight the aspects that critically support the successful implementation of BBS safety programs and need to be considered while designing them. This research article has implemented the technique of systematic literature review to analyse, synthesise critically and plot the framework by narrowing comprehensive themes from the entire process. The review process starts by defining a time range, selection of databases, identification of relevant article, and finally classification. Databases from Science Direct, Taylor & Francis, Sage, Emerald and Wiley's online library, etc., were explored, and 29 research articles published between 1999 and 2024 were organised for analysis. As a result, organisational and individual factors emerged as two broad categories of factors that influence the process of implementation. Further, the result also shows BBS innovations such as the identification of unsafe behaviour using 2D images, the concept of adjusted BBS, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) to evaluate the BBS risk, skill training on virtual reality platform improves the efficiency of the process. Further, the study discusses the success of the BBS process and the associated challenges that affect the successful implementation of the BBS process. In the non-appearance of any systematic research of existing research publication on BBS and factors influencing the implementation process, the result of this review article will serve as a guide to safety practitioners and researchers.
Keywords: *Behaviour-based safety, organisational factors, individual factors, workplace safety, safety-related behaviour.*

INTRODUCTION:

Protection of the workforce and consideration to the health and well-being of the workforce form a basis for the economic growth of countries. Improvement of working conditions, designing working methods and equipment following the functional and behavioural abilities of individuals can substantially reduce the likelihood of mistakes and inappropriate behaviours of individuals placed in various work situations and can provide a favourable work environment to the workforce (Schall el al.,2018). Many research articles from the past have reported excellent success of BBS in different countries and industries.

Previous research identified humans and the occurrence of unsafe behaviours in various work situations as the most prominent cause of accidents in the workplace, more than 80% - 85% of accidents in the petrochemical and chemical industries are caused by human failure (Gurses et al.,2019; Baybutt, P. 2016; Beseler & Stallones,2010). Behaviour-based safety is one of the concepts used to promote safe behaviours of employees. BBS identifies and modifies behaviours that can lead to occupational or potentially cause accidents (Javadi et al.,2013). BBS interventions positively contribute towards reducing error and influencing behaviour, thereby preventing accidents (Gh et al., 2021). Heinrich concluded that 88% of these accidents have been caused by unsafe behaviours (Hollnagel E.,1998). Whereas, only 10% have occurred due to an unsafe environment. Furthermore, Rashid et al. (2023) reported an analysis shared by various agencies. These include DuPont, Behavioral Science Technology and Quality Safety Edge who have reported that 96, 80 and 76% of accidents have been caused by unsafe behaviors/unsafe acts, respectively. Thus, a significant reduction in unsafe behaviours reported by the implementation of the BBS program primarily necessitates the systematic review of the available literature to narrow down the focal points of this method. Existing research on the methods of BBS is mostly limited to the influence of BBS in improving health and safety, measuring the effectiveness of BBS, advantages and criticisms of BBS, critical success factors of BBS, and critical success factors. There is the absence of any research on BBS using systematic literature review (SLR)methods.

Therefore, the research paper aims to explore factors capable of influencing Behavioural-based safety implementation and empirical evidence of BBS in improvement in workplace safety. In addition, the papers also explore the latest innovations in the process of implementation and associated challenges. For this purpose, the following research questions are framed.

RQ 1: What are the contributing factors that make Behaviour Based Safety Intervention (BBSI)effective?
RQ 2: How does Behaviour Based Safety (BBS) benefit workplace safety?
RQ 3: What are recent innovations in BBS that have the potential to benefit behavioural improvement outcomes?

A The framework of Behaviour-Based Safety:

Given the importance of safety behaviour in accident prevention, behaviour-based safety (BBS) has received significant attention since the 1970s. There is no exact definition of BBS, but it is very often used as a range of safety interventions that focus on the front-line workers behaviour (Wirth and Sigurdsson, 2008). It is a "bottom-up" approach which aims to identify and alter critical unsafe behaviour through a blend of observation, feedback, training, and goal setting. Initial applications of behavioural techniques to safety can be traced back to the 1970s, when positive reinforcement was a principal element of BBS programs (Guo et al., 2018). In this approach, more attention is directed towards motivating and rewarding people to reinforce safe behaviours. To achieve this goal, the emphasis is placed on staff training, prioritising target behaviours, recording observations of safe behaviours of employees by their peers and supervisors, employee participation in designing and implementing the intended program, and providing feedback (Motamedzade , 2013; Zhang et al., 2017).

BBS is an approach associated with a safety management system towards improvements of safety and health performance. BBS processes are effective in raising the level of safe behaviour and safety as an alternative to reduce accidents and injuries in the industry. Although many factors may affect the final outcome or results of the behaviour-based safety approach, this difficulty is largely attributed to the strategy and its process of implementation (Galis et al., 2018). BBS can also be elaborated as "a set of techniques that intend to encourage or discourage people for a specific behaviour to prevent work-related accidents and illness before they occur. The implementation of such a program necessitates the setting up of goals, establishing observation techniques, conducting observation, recording and analysing the causes of unsafe behaviour and creating an effective communication system" (Pęciłło, 2010). Or, simply, "BBS focuses on people's actions, analysis of their actions and then applies a research-driven strategy to improve what people do" (Geller, 2001). The background of the BBS methodology can be linked to the works of Heinrich 1927, 1928, 1929, 1931, 1941, as cited by Swuste et al., (2010) and Choudhry (2014), who claimed that around 88% of industrial accidents are caused by unsafe behaviour. Geller (2001), in their research on applied behaviour, assumes an antecedent-behavior-consequence (ABC) model. Antecedents work as "triggers" of behaviour, while the consequences – positive or negative – determine the probability of repetition of the behaviour in the future. Therefore, providing workers with positive consequences – rewards (positive reinforcement) may enhance the probability of the desired behaviours, whereas penalties (negative reinforcement) can discourage them from the undesired, risky ones. The rewards and penalties may take different forms, from positive or negative feedback, through celebrations and parties for reaching set goals to financial incentives and even lay-offs (Skowron-Grabowska and Sobociński, 2018). BBS is considered to be a leading indicator that has been widely recognised (Ting et al., 2020) and has the potential to improve workplace safety. Research continues to suggest that BBS is often as effective as engineering controls and more effective than common safety committee interventions (Guastello,1993). While engineering controls are more effective at eliminating a single hazard, behavioral interventions are typically able to address a broader range of hazards, resulting in the reduction of many types of injuries. With a relatively steady flow of case studies (Hagge et al., 2017; Myers & Sadaghiani, 2010), BBS is perhaps the most empirically validated approach to controlling injuries in organisational environments. The researcher has studied various journals, research papers and books by different authors to explore the contributing factors of successful implementation of Behaviour Based Safety Intervention (BBSI), the latest innovations in this field and related challenges. The remaining sections of the paper consist of research methodology, findings, discussion and conclusion.

zcx:

The study was conducted following the systematic literature review (SLR) suggested by Tranfield et al. (2003), and Crossan and Apaydin (2010) on BBS, aiming at exploring the components of BBS and factors affecting implementation of BBS. This research article has implemented the technique of systematic literature review to analyse, synthesise critically and plot the framework by narrowing comprehensive themes from the entire process. Following Bhatt & Muduli (2022) and Purohit et al. (2021), the review was conducted by selecting a database, identifying a time horizon, choosing articles, and analysing and classifying them chronologically.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 5, 2025
https://theaspd.com/index.php

Time horizon for the selection of papers

For the review and assessment process, the available literature from 1999 till 2024 in selected books and literature has been considered (Figure 1). We choose to keep a time horizon for a boarded period as few researches has been conducted on BBS. The rationale for beginning the search in 1999 is primarily to present a more updated version of the information. During the search, it was also found that research on behavioural safety gained momentum in academics only after 2015.

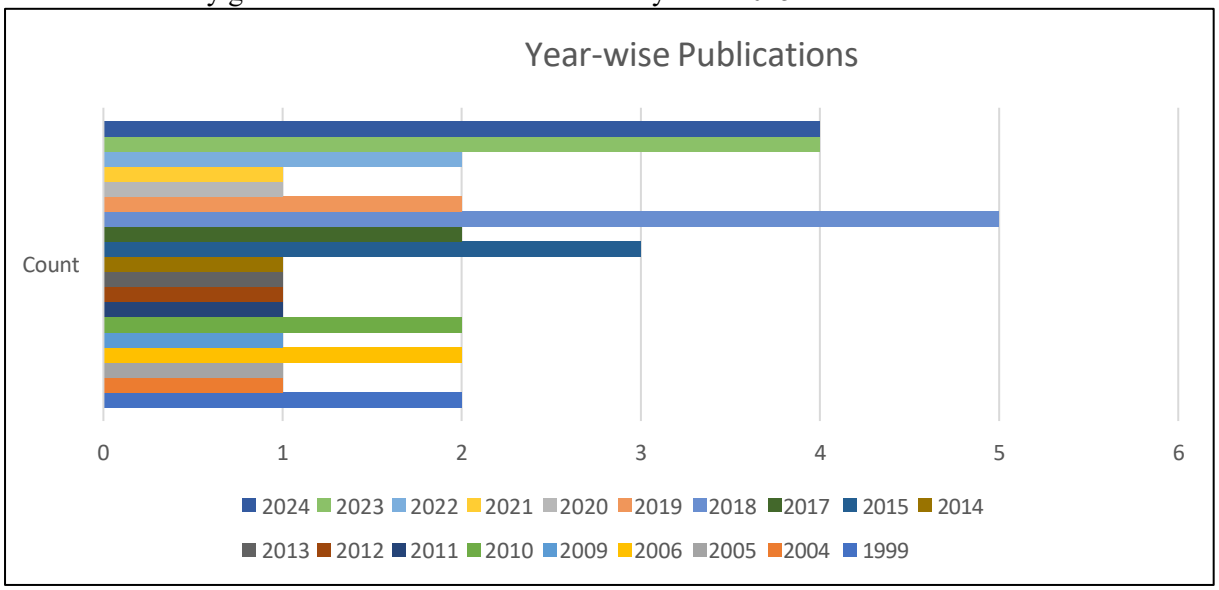

Figure 1: Identification of time horizon

Selection of databases

The research has explored many online databases to prepare database of research articles on BBS. The review process was carried out in the English language, and the sources were mostly electronic databases of Emerald Insight, SAGE Journals, Science Direct, Inderscience, Elsevier, Springer Link, Taylor and Francis and Wiley's online library, etc. were used. Although the study attempts to include most of the available literature on BBS, but the does not claim the database is either complete or exhaustive in nature.

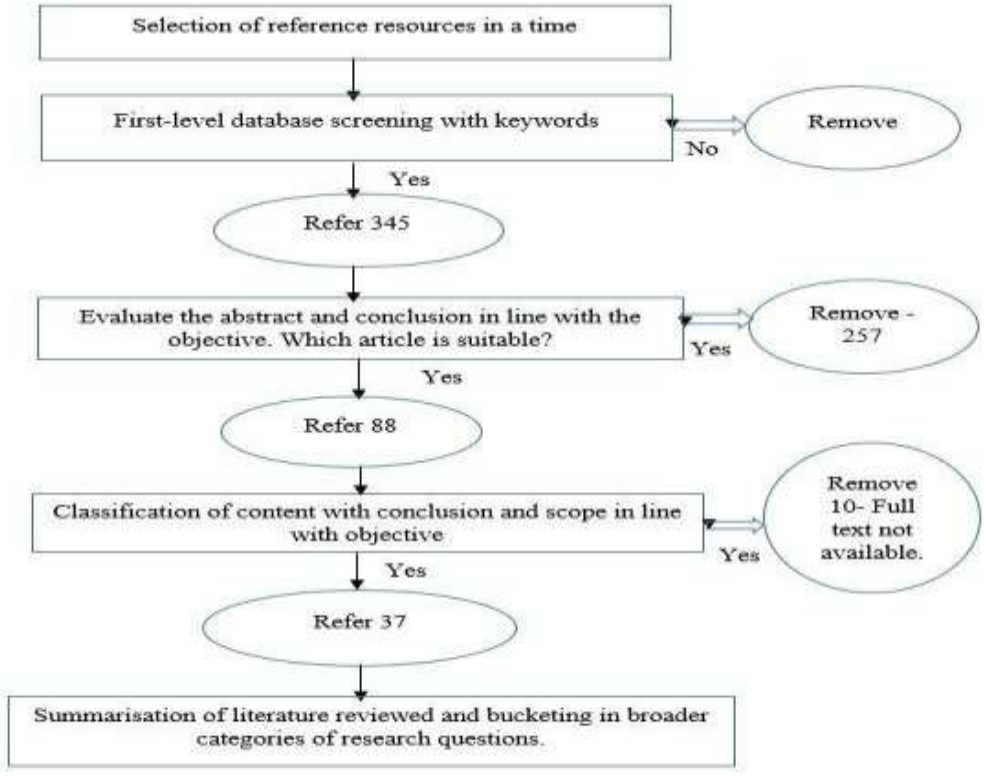

Figure 2: Process of article identification

Selection of articles

The detailed process of literature search is defined with the help of a chart (Figure 2). Articles from the databases were selected with the help of keywords to search through relevant journal articles published between 1997 and 2024. The major keywords were "Behaviour-based safety" and "Behavioural safety". Non-relevant articles were eliminated to stay focused on the objective of the study. An initial search on the electronic database resulted in 345 outputs. Based on the observation (by article titles), 88 articles were found suitably related. The omission criteria were a similarity, unrelated to the theme and comprehensiveness of the selected article, which includes the output of other articles and makes it omissible. Out of 88 articles, some articles were completely not available. Therefore, the abstract and objectives of 78 articles were thoroughly studied. Finally, a count of 37 manuscripts were found eligible and suitable for inclusion in the process of systematic literature review.

RESULT & DISCUSSION:

Despite the successful implementations reported in the previous studies, the present study aims to explore factors contributing to the successful implementation of behaviour-based safety programs and needs to be considered while designing the intervention. The present research also reviews and summarises the results of research conducted in the past and demonstrates the improvement of workplace safety through the implementation of BBSI. In addition, the recent developments and innovations in the area of behaviour-based safety (BBS) are also discussed.

RQ 1: What are the contributing factors to the successful implementation of Behaviour Based Safety Intervention (BBSI)?

Many researchers have identified the factors/precursors contributing to the successful BBS implementation. But there lies a gap in the segregation of those factors. The factors relatively differ in terms of their impact on BBSI and their path of influence. To overcome the gap this study explicitly reviewed the available literature and categorically divided the factors into two broad heads: Organizational and individual factors. Findings: As per Reason (2009), accidents are caused by organisational factors that can influence the behaviours of individuals related to work. He claims that unsafe acts can be observed due to poor organisational factors and explains that human conditions cannot be changed, but the circumstances in which they work can be changed. Theory and research identify leaders' behaviours as the most critical factor for safety outcomes. Therefore, the joint role of Perceived leadership behaviours (Leader's support and communication) and attributions about leader safety commitment (i.e., affective, normative and calculative safety commitment) is examined. The results demonstrate the distinct functions of perceived leadership behaviors and different attributions of leaders' safety commitment in motivating safety behaviour (Safety participation & and safety compliance) in employees. Effective safety commitment attributions of leaders are found to have positive linkages with the workers safety behaviours. Leader calculated commitment to safety was negatively linked with safety compliance, and attributions about leader safety commitment moderated the link of perceived leadership behaviours with safety participation (Fruhen et al.,2022). Most of the BBS methods in practice practically fail to recognize the effect of the interactions between the supervisors and workers. To overcome this limitation, the impact path of supervisor behaviours on safety climate and workers' behavioural performance is studies by Zhang et al. (2017) in this study. The analysis of statistical data proved that intervention that considers and gives due importance to supervisor behaviours resulted in significant positive changes in the safety climate, the workers' behavioural performance, and the sustainability of BBS impacts. The results also demonstrated focus on supervisor behaviours is considered to be a practical approach for maximising the effectiveness of the program and sustaining behavioural change for improving workers safety performance in the construction industry. The experimental study conducted by Johnston & Hayes in 2005 examined relevant variables affecting the results of a behavioural safety program in a controlled environment and found that the group trained with a safety rule, on average, performed at (or below) the specified 10% injury rate. In contrast, the group without being explicitly trained on safety rules seem to report a significant increase in safe behaviour. The role of human factors in the oil industry was studied by collecting primary data on safety knowledge, behaviour and risk perception through structured questionnaires from shift, daily and outsourced workers. It was found that training has a strong impact on safety behaviour and risk awareness (Fabiano et al.,2022). Wang et al., in their study conducted in 2018, measured and compared the effectiveness of BBS education methods and confirmed the effectiveness of BBS education in reducing safety-related events. A superior understanding of the benefits

of BBS is very important to be considered while implementing BBS in any organisation. In the absence of the support of the superior, it is not possible to implement Behaviour-Based Safety (BBS). It's only when the top management comprehends the idea and benefits of BBS it can be successfully implemented as top management is the decision maker. The challenge that affects BBS implementation in the company is the superior's understanding of the benefits of BBS. The support of the senior management exerts a positive impact on the workers. By only understanding that BBS can be benefit to the company's safety performance, could the superiors support workers to practice BBS". Due to its significant importance and being a prerequisite, "safety culture "continues to be a critical contributing factor affecting the implementation of BBS. However, several companies do not have a good safety culture and thus find it challenging to implement BBS programs. In the absence of safety culture, it is difficult to convince the management of the importance of safety to implement this proactive safety approach (Galis et al.,2018).

Factors	Sub-factors	Authors
Organisational Factors	Data Management system	Galis et al. (2018)
	Financial Aspect	Galis et al. (2018)
	Lack of action plan	Galis et al. (2018)
	Top management's awareness and visible support	Galis et al. (2018)
	Failure to teach BBS principles to all workers	Galis et al. (2018)
	Safety Culture	Galis et al. (2018), Ghautham & Suresh (2021)
	Employee participation in designing and implementing the intended program	Gh et al., (2021)
	Leaders safety commitment	Fruhen et al., (2022)
	Management credibility	Spigener et al., (2022).
	Supervisors Behaviour	Zhang et al. (2017).
	Safety Education	Wang et al. (2018)
	Safety Training	Fabiano et al., (2022), Johnst et al., (2005), Spigener et al., (2022). Gh et al., (2021)
	Safety communications	Spigener at el., (2022).
	Maintenance of Equipment	Ghautham & Suresh (2021)

Table 1:Organisational factors

Primarily, BBS intervention focuses on external factors while designing the intervention for the reinforcement of safe behaviours while ignoring and paying less attention on internal factors such as attitudes, BBS awareness, human values and lack of safety knowledge (Zhang & Fang,2013) and the employee's involvement in the program. Behaviour-based safety attitude identifies and modifies behaviours that are potentially effective causing occupational accidents. As per Manu et al. (2017) the success of the BBS program relies on an insight into the significant intrinsic drivers, such as human values and the role they play in worker's safety-related behaviour. The benefits of behavioural safety initiatives have been displayed by a number of organisations (Krause,2000). The collaboration of occupational and environmental health and safety professionals in their efforts can positively impact the health and safety of employees and overall organisation. BBS relies on employee involvement and strongly emphasises observation, feedback, measurement, positive reinforcement, and evaluation (Haney & Anderson,1999). Safety attitude has a major contribution in order to enhance the BBS. Safety attitude factors have never been reported for the safety improvement of a fertiliser complex. Therefore, Rashid et al. (2023) attempted to engage the safety attitude factors to enhance the BBS of employees at a fertiliser complex and found an overall improvement in the working environment and safer operations. Ajayi et al. (2021) investigated the challenges associated with behavioural safety measures for addressing accidents in Qatari Mega projects. The results indicate a lower level of behavioural safety awareness among the workers of construction industry due to lack of optimum safety knowledge and improper use of safety gear. Prioritising production over safety due to project timeline. In an attempt to investigate relation between construction worker BBS awareness and rate of physical injury/accidents and found a correlation between

general necessity for BBS and its awareness.BBS awareness was found to have a notable impact in risk reduction.at workplace (Nasir et al.,2023).

Factors	Sub-factors	Authors
Individual Factors	Human Values	Zhang et al., (2013), Manu et al., (2017)
	Employees/workers involvement	Haney & Anderson (1999).
	Safety Attitude	Rashid et al. (2023), Galis et al. (2018), Zhang & Fang (2013)
	BBS Awareness	Zhang & Fang (2013)
	Lack of Safety Knowledge	Ajayi et al., (2022)
	Safety Awareness	Nasir et al., (2023)

Table 2: Individual factors

RQ 2: How does Behaviour Based Safety (BBS) benefit workplace safety?

There are enough evidences for BBS as an effective intervention for reducing injuries and improving workplace safety. The "success" of BBS programs can be defined in many ways, as different measures and rates used by researchers (Table 3). Findings: The empirical basis for BBS continues to mature and offer guidance to both practitioners and organisations. Research continues to suggest that BBS is as effective as engineering controls and even more effective than any commonly used safety committee interventions. Olson & Austin (2001) attempted an experimental evaluation of Behavior-Based Safety(BBS) processes implemented through a self-monitoring package on lone workers (bus operators) and found overall effects of the intervention from small to moderate with a 12.3% increase in groups' safe performance and 2% to 41% increases in the safety performance of individuals. Beyan and Tursucu (2017) discovered that implementation of BBS addressed ergonomic inadequacies leading to musculoskeletal diseases and recorded a significant decrease in ergonomics risk factors at work. A study carried out in a cement company in Zimbabwe in 2018 demonstrated a significant decrease in injury and accident numbers and positively affected the workers mindset towards safe work practices (Nunu et al.,2018). Dinagaran et al. (2019) examined and recorded an improvement in safety performance from the baseline of 57.35% to 77.94% in a month's time after implementation. Gh et al. (2021), in a recent study, revealed a remarkable improvement in the safe behaviour of supervisors after the implementation of BBS interventions by using the theory of planned behaviour as a theoretical framework and found the most suitable theory for designing, planning and implementing interventions to promote safe behaviours at workplace. A reduction in unsafe behaviours was noted at a fertiliser complex after implementing the BBS program. The authors reported an increase in safe behaviours from 57% to 70% and a notable reduction in unsafe behaviours from 40% to 26%, along with an increase in employee morale (Rashid et al.,2023). The results of the study conducted by Jerie & Baldwin (2017) to measure the effectiveness of BBS in pine processing plants recorded a double-digit figure in occupational accidents and recoded zero in major environmental spillages by the end of 2016 as against triple digits of near misses and occupational-related accidents. BBS contributes in reducing personal injuries and can be applied to preventing catastrophic incidents by not just looking at the cause but foundational root causes, such as leadership shortcomings and system failures, by providing greater specificity of the precursors to serious incidents and greater precision for the behaviour analysis (McSween & Moran, 2019). Zhang & Fang (2013) strategically integrated BBS practice in regular management routine through a Supervisory-Based Intervention Cycle (SBIC) and a Behavior-Based Safety Tracking and Analysis System (BBSTAS) at the work site and found that applications of SBIC and BBSTAS as continuous BBS strategy has potential to achieve safety improvement in construction industry.

Improvement in Workplace Safety through BBS Program	Authors
Safety performance of Groups (12.3%), Safety performance of individuals. (41%).	Olson and Austin (2001)

Reduction in ergonomics risk factors.	Coskun-Beyan et al., (2017)
Decrease in accident and injury occurrence, positively influenced the mindset of workers.	Nunu et al., (2018)
Safety performance improvement (from 57.35% to 77.94%)	Dinagaran et al., (2019)
Safe behaviour improvement of supervisors	Gh et al., (2021)
Safe behaviours increase (57% to 70%, reduction in unsafe behaviors (40% to 26%)	Rashid et al. (2023)
Accident rates fall (triple-digit to double-digit), "0" environmental spillage.	Jerie & Baldwin (2017).
Reducing personal injuries.	McSween & Moran (2017).
Integrate BBS practice into management routine at work site	Zhang & Fang (2013).

Table 3: Workplace safety through BBS

RQ3: Do innovations in BBS have the potential to benefit behavioural improvement outcomes?

The SLR explored and identified several critical innovations related to BBS in last few years that has the potential to benefit the traditional process of implementation in a prominent way. Summary of the innovations and their usefulness BBS intervention are explained in Table 4.

Findings:

Some research findings challenge traditional assumptions in the BBS initiative. Fang el at. (2020) examined the integration of computer vision with deep learning to support BBS intervention and the use of computer vision to prevent people from entering working areas while heavy equipment is being used and identify unsafe behaviour from 2D images arising on construction sites. Ting et al. (2020) explained the benefits of an adjusted BBS observation program where observation is done by front-line workers as against the traditional BBS in terms of observation done by consultants or supervisors. This results in the improvement of observers' safety awareness and deepens safety knowledge by repeatedly observing other workers, thus making them alert to their own behaviour so as to act as models. This makes observation less obvious and visible. The study introduced the process of using TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) to assess the BBS risk in any project and help managers propose countermeasures to mitigate the risk of occupational accidents. Ting et al., (2020) claimed higher the amount of recorded unsafe behaviours (ARUB) on a project, the lower the total recordable case rate (TRCR). In an attempt to investigate the impact of VR-based (virtual-reality) training on acquisition of knowledge ,operational skills of construction workers and safety behaviour during robotic teleoperation compared to the traditional in-person training method and found that VR-based training led to the significant increase in knowledge, safety behaviour and operational skills compared to in-person training and VR-based training should be considered an more effective platform for future safety training programs (Adami et al., 2021). The results of the study conducted by Cambridge University using data provided by DEKRA clients involving 1.3 million observational data points of 88 international clients, including monthly incident and culture survey data, challenged the traditional assumptions of BBS initiatives by strongly suggesting to have a limited number of "dedicated observers" as against participation from all employees. The study also recommends that in order to be more effective, the observations should be less frequent (Spigener et al., 2022). In order to overcome the limitations of traditional BBS, Manu et al., (2023) presented a conceptual framework to integrate digital technologies into conceptual aspects of BBS. Conceptual framework specifying the synergy between traditional and modern BBS and sensor technologies to address the common pitfalls of traditional BBS.

Ding et al., (2024) proposed the concept of human behaviour–detection (HBD) dataset for deep learning in public emergency safety. The HBDset possess the potential to enhance public safety, provide early disaster warnings and prioritise the needs of vulnerable individuals.

Innovations in BBS	**Authors**
Computer vision, identify unsafe behaviour using 2D images.	Fang et al. (2020)
Adjusted BBS, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) to assess the BBS risk.	Ting et al., (2020).

Adjusted BBS observation program, ARUB (Amount of Recorded Unsafe Behaviors), inversely proportional to TRCR (Total Recordable Case Rate).	Ting et al., (2020)
VR-based(virtual-reality) training for operational skill and knowledge better as compared to in-person training for improvement in safe behaviour	Adami et al., (2021)
A limited number of "dedicated observers" as against participation of all employees, once a month observation vs frequent observation, observer's familiarity with tasks as against observers "with a fresh pair of eyes.	Spigener et al., (2022)
Integration of digital technologies into conceptual aspects of BBS	
Human behaviour–detection (HBD) dataset for deep learning in public emergency safety is proposed as the HBDset.	Manu et al., (2023)
	Ding et al., (2024)

Table 4: Innovations in BBS

Practical implications of the study:

The empirical basis for BBS is getting matured with time and provide guidance to organisations and safety practitioners. The results of this study can have meaningful implications for practitioners. Firstly, the study revealed the importance of individual as well as organisational factors in successful implementation of BBSI.The success of any behavioural modification program intended to reduce workplace incidents and accidents requires the practitioners to understand and appreciate the contributing factors that affect the implementation of BBS. The interventions mostly focus on organisational factors while designing the intervention by paying minimal to no attention on internal factors such as attitudes, BBS awareness, human values and lack of safety knowledge (Zhang & Fang,2013) and employee involvement in the program. The results of this study will sensitise practitioners to pay equal attention to both factors while designing and implementing the BBS program. Secondly, a statistically significant reduction in injuries/accidents is observed after implementing BBS intervention in the workplace. Three other studies reached similar conclusions based on qualitative reviews: McAfee and Winn (1989) concluded that incentives and feedback were effective means of reducing accidents; Sulzer-Azaroff and Austin (2000) stated that 32 out of 33 articles they reviewed reported reductions in injuries after conducting a BBS intervention; Grindle et al. (2000) derived from their review that behavioural safety is an effective way of increasing safety performance in manufacturing settings. The findings of this study can be used as a guide to the critical stakeholders, i.e. operation heads, safety officers, middle managers, front-line managers, decision-makers, administrators and finally, the organisation as a whole in Improving workplace safety. Thirdly, the study provides instant clarity to practitioners about latest innovations and the related benefits in implementing BBS.Use of 2D images to identify unsafe behavior, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) to assess the BBS risk, concept of adjusted BBS, VR-based(virtual-reality) training for operational skill makes the process less time consuming and more cost effective as compared to traditional BBS practices. Finally, the result suggest supervisor behaviours, managing work-safety tension, data-management ,top management commitment to the process ,employee acceptance towards the program, organisational safety culture and financial barriers emerged as major challenges.Practioners may align their attention on managing supervisor behaviours, managing work-safety tension by minimisng goal-conflict , effective data-management ,top management buy-in for the process, ensuring employees acceptance, ensuring organisations safety cultural and financial readiness to ensure the successful implementation.

Limitations and future research scope of the study:

This study formed a basis that can be used by the safety practitioners who plan to implement BBS in their organisation. Despite our first attempt to explore behaviour-based safety as a process, this research may suffer from several limitations and hence offers key points for future research. Firstly, the current research explored the factors that influence the implementation of BBS, evidence of improvement in workplace safety through BBS, and its challenges, irrespective of the stakeholders. Future research may be planned to focus on specific stakeholder and their path of influence on the process of implementation. Secondly, the study was conducted by considering the published work between 1999 and 2024 and by using the SLR method to use the best possible ways to include maximum related keywords. There might be a

possibility of missing some relevant studies available in some languages. We might have missed articles during search time if they are available in the database other than those mentioned in the methodology section. Hence, future research can be conducted on a broader database, intervals and reading sources. Finally, the study is solely based on a secondary database. In the absence of primary data, the study result may not be reliable. Future research can be planned in a more meaningful way to explore the process of BBS by collecting data from primary sources.

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