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Article

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OPERATIONS MANAGEMENT | RESEARCH ARTICLE

Harmonizing work safety and health practices towards technician's productivity in the workplace: A modified theory of planned behaviour

Olabanji Taiwo Shodipe^{1*} and Ifeanyi Benedict Ohanu²

Abstract: Several technicians have been exposed to danger and varying degree of risk, exposed to diverse grades of occupational and health hazard, injuries and death which may arise from accidents. Several factors that cause these accidents range from inadequate experience, short job tenure, insufficient training, etc. Therefore, this study harmonizes safety and health practices at work towards technician's productivity in the workplace. A total of 1,080 registered technicians in

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PUBLIC INTEREST STATEMENT

The study focused on safety and health practices in the workplace and its influences on technician's productivity. Job safety, coworker's safety, supervisor's safety and management of safety practices influence technician's attitude, subjective norms, perceived behavioural control and intentions to engage in safety behaviour to improve work output or productivity. The study suggests that through the research framework, curriculum developers should consider the aforementioned factors to develop an all-encompassing safety curriculum. Teachers and/or instructors are safety role model and implementers of curriculum that should encourage learners to engage in positive safety behaviour.

workplaces in Lagos State, South-West region, Nigeria, were used as sample in this study. The samples were selected using purposive sampling technique. Exploratory and confirmatory factor analyses were used during the empirical analysis to achieve the model fits. The study shows that there is a significant influence of the health and safety practice constructs (job safety, coworker's safety, supervisor's safety and management of safety practices) on the construct of theory of planned behaviour (attitude, subjective norms, perceived behavioural control and intentions) to further enhance technician safety and health practices/safety behaviour. The result from the study indicates that school-based occupational safety and health education may contribute to future reduction in job-related injury, to ensure that safe and healthy work becomes important to the student experience.

Subjects: Health & Safety; Health & Safety at Work; Occupational Health & Safety;

Keywords: Safety and health practices; accident; productivity; safety attitude; workplace safety

1. Introduction

Several technicians have been exposed to danger and varying degrees of risk (Smit & Esterhuyzen, 2014) or rather exposed to various kinds of occupational, health hazards, injuries and death which may arise from accidents. Several factors that cause injury in the workplace are inadequate experience and short job tenure (Bena et al., 2013), vulnerability to risk taking behaviour (Yildirim et al., 2020), lack of supervision and lack or insufficient training (Samanta & Gochhayat, 2021), minority status (Gross et al., 2021; Saadi et al., 2022), engaging in job without PPE and work overload (Dodoo & Al-Samarraie, 2021), even despite existing labour laws meant to protect them (A. K. Ramos et al., 2021; Alam et al., 2022). The incidents have declined their state of health and well-being and a reduced work performance (Thangam, Jeshurun, Thangapoo, Gnanaraj, Appadurai, 2022).

Technicians' unsafe act and non-adherence to safety precautions result to different grades of injuries and death (Salvaraji et al., 2022). Accident occurrences are a product of insufficient compliance to safety protocols, rules and regulations, and non-proactive to safety issues as stated within the workshop (Clare and Kourousis, 2021; Lam et al., 2022). Accidents could be a consequence of risk perception or, more precisely an inaccurate perception of risk (Noel et al., 2021; Sheykhfard et al., 2021). Accident in the workshop causes serious situations that significantly affect organizations, the workplace administrators and the workers (Dominguez-Péry et al., 2021; Soman et al., 2021). Workshop accident involves slip and falls, collision with moving or static objects/bodies, exposures to hazardous substances or environment, electrical hazards and occupational injuries (Zhao et al., 2019). Hazards in the workshop are inevitable but can be reduced to the barest minimum. This category of hazard includes contact with electric current, contact with extreme temperatures, caustic and noxious substances, radiation and oxygen deficiency (Ammad et al., 2021). There is a need to determine the cause of accident to be able to control hazards and successfully build accident prevention techniques that rely on the knowledge about the causes of accidents (Newaz et al., 2021).

A technician is a worker with proficient technology skills who can apply or transform theories to practice (Cambridge dictionary, 2022). Technicians have many areas of specialization in several technology-related occupations. The construction industry includes roofers, painters, carpenters, builders and electricians (Obianyo et al., 2021; Zhu, Dutta and Dai, 2021); telephone technicians (Brenner & Majano, 2022); health technicians (Adams et al., 2022; Oshima, 2021); pharmacy technicians (Chong et al., 2022); engineering technicians (Winberg, 2021); electrical technicians (Ab Hadi et al., 2015), etc.

Technician's safety practices in the workplace or workshop reduce accidents or injury to the barest minimum. Safety is the prevention of unforeseen occurrences that may lead to wastage of materials, damage of tools and equipment, injury or death of the personnel, and improved productivity. Safety in the workplace should be enhanced by worker behaviour (B. O. Wang et al., 2021; Chellappa et al., 2021; Khan et al., 2022). Most technicians' behaviour are usually not predicted since they are influenced by the nature of their job instructions, condition of the work environment, equipment used, personality traits and physiological and psychological stresses (Brauer, 2016). The use of protective measure and adherence to safety measures is an indication of a deliberate action done to improve work output or productivity (Zhu, Dutta and Dai, 2021; Guidry et al., 2021; Olukolajo et al., 2022; Rosemberg & Li, 2018). The safe working environment of an organization tends to foster workers' efficiency and effectiveness at work.

One of the important theories that critically explain intention and behavior is Ajzen's theory of planned behaviour (TPB) (Watsi & Tarkang, 2021; Yazdanpanah et al., 2022). Reviewed literatures indicated that only few studies explained safety research (Asad et al., 2021; Bhagwat & Delhi, 2022; Syed-Yahya et al., 2022), work safety and healthy behaviour in the workshop/workplace by applying TPB (Hatami & Kakavand, 2022; Ledesma et al., 2018; Mohammadrezaei et al., 2022; Norris & Myers, 2013). Some safety literatures revealed that the nature of the organization influences employees' behaviour (Newaz et al., 2019). Some others involving the TPB model studied the relationship between safety climate and safety behaviour (Baby et al., 2021; Kalteh et al., 2021; Reneclé et al., 2021). The theory helps to identify the components that associate work safety and health practices to safety behaviour. More importantly, most of the safety researches were done in developed countries where safety practices and procedure are handled at optimum while little or no safety research has been done in developing and underdeveloped countries like Nigeria. In this study, the work safety and health practices constructs are used as an antecedent of TPB to predict technician's safety behaviour in the workplace.

The harmonious relationship between work safety and health practices can improve technician's productivity in the workplace. However, there is no substantive research that has been conducted using work safety and practices to influence technician's productivity in the workplace with consideration on the TPB in a single model in Nigeria. Therefore, this study investigated by harmonizing work safety and health practices towards technician's productivity in the workplace by applying the TPB in Nigeria with consideration on exogenous variables like technicians' job safety, coworkers' safety; supervisor's safety, management of safety practices and safety programme.

This paper proceeds as follows: literature review, methodology, results, discussion of the findings, implications and limitations.

2. Literature review

2.1. Theory of planned behaviour

It is a theoretical framework that has been applied to several researches that deal with human behaviour (La Barbera and Ajzen, 2021; Sok et al., 2020), health-related behaviour (Servidio et al., 2022; Sniehotta et al., 2014; Tarker, 2022), entrepreneurial behaviour (Arshi et al., 2021; K. D. Singh & Onahrng, 2019; Shodipe & Ohanu, 2020), smoking behaviour (Blonde et al., 2022; Simpson et al., 2022), usage of mobile learning (Afacan & Muhametjanova, 2021; Shodipe & Ohanu, 2021) and academic dishonesty (DiPaulo, 2022; Juan et al., 2022). The theory presumes that behavioural intentions predict behaviour. It suggests that three factors predict individuals' intentions: attitudes, subjective norms and perceived behavioural control (La Barbera & Ajzen, 2021). Attitude is an individual's characteristic which portrays either positive or negative behaviour or reflection of feeling and knowledge of safety practices in the workshop (Hussein, 2017). Subjective norm is the expectation that essential people will accept and support work safety and healthy practices. It is influenced by societal pressure from important people like workshop supervisors and coworkers

who obey work ethics, safety and healthy practices in the workshop and their motivation to adhere to workshop safety rules and regulations (Ham et al., 2015). Perceived behavioural control is the extent to which technicians feel that it is their choice to perform certain safety behaviour. At this stage, the technician performs safety and healthy practices if he believes there are safety resources or equipment to perform safety behaviour but may not perform safety behaviour if there is no equipment despite formation of positive attitude towards it or believe that other important persons will approve it (H. Chen et al., 2021; Hamid et al., 2019).

With several substantive supports that TPB predicts behaviour, researches continue to add constructs that could influence the predicting abilities of the theory (Damalas, 2021; Gamel et al., 2022). Existing literatures on TPB had modified the theory by adding other variables (DiPaulo, 2022; Juan et al., 2022). Several authors have included several exogenous variables that have direct, indirect, positive and negative effects on the constructs of TPB. Some of the variables include moral obligation (Canova et al., 2022; Juan et al., 2022), management safety attitude (T. K. M. Wong et al., 2021; U. Khalid et al., 2021), entrepreneurial resources (Ohanu et al., 2020; Shodipe & Ohanu, 2020; Shodipe et al., 2020), family formation and fertility (Lindstrom, Hernandez-Jabalera and Saucedo, 2021; Malling et al., 2022), traffic safety (Rowe et al., 2016), speeding (Dinh & Kubota, 2013), distraction (Prat et al., 2015), socio-cognitive variables (Riaz et al., 2019) and other related variables. In literatures, the TPB model has been extended with the combination of other theoretical frameworks like C-TAM-TPB (Ohanu et al., 2022), C-VBN-TPB (Chen, 2020) and C-TPB-EEM (Sharahiley, 2020), and these models give a robust significant relationship between the antecedents of TPB. To reflect the use of modified TPB in this study, other exogenous variables were added with the TPB model, including Coworker's safety, Job safety, Supervisor's safety, Management of safety practices and Safety programme (policies and training).

With utmost consideration of literatures, a modified TPB model is inevitable; hence, the present study adds to the robustness of existing study that exogenous variables enhance the quality of TPB models. Also, the main goal of this study goal is to assess the reputes of the modified TPB model on technician's safety and health practices towards improved productivity in the workshop. The essence of this is to help improve health and safety practice in technical education institutions, improve the work ethics and behaviour of technicians in workshop, and reduce workshop fatalities and exposure to hazards.

With critical reviews on safety behaviours and its antecedents to adopts health and safety practices among technicians, it was hypothesized that

- H1.** Technician's safety intention positively influences their health and safety practices.
- H2.** Technician's safety attitude negatively influences their intentions towards health and safety practices.
- H3.** Technician's subjective norms positively influence their intentions towards health and safety practices.
- H4.** Technician's perceived behavioural control positively influences their intentions towards health and safety practices.

3. Job safety

Accidents are prevalent at work and could translate into many other accidents of different grades (Rahim & Hassan, 2021; Wen et al., 2021). The roles played by personnel in accident occurrence are indisputable. Inadequately trained personnel, lack of safety training, inadequate supervision and insufficient safety skill are major contributors to injury at work (Guerin & Toland, 2019). The health and safety culture of a workplace is as a result of the individuals' values, attitude, approaches and

behaviour that influence their involvement in health and safety activities in workplace (Long et al., 2022; Vahedian-Shahroodi et al., 2016) and determine the rate of work output. Alenazy et al. (2021) and Dodanwala and Santoso (2022) explained the relationship between adequately safe workplace environment and work output. Hence, a safe work environment will improve safety behaviour among workers exposed to physical and psychosocial strain (Bronkhorst & Vermeeren, 2016). This could be achieved when the institutions or employee took safety at high esteem and invest into various safety activities or equipment to enhance workers well-being. Many researchers have looked at the effect of workplace safety on job performance (Bedi, 2019; Kao et al., 2021; Muis et al., 2021), safety behaviour (Ceren & Ali, 2014), knowledge and motivation, etc. This study investigates job safety as an antecedent of TPB model. Hence, it was hypothesized that

H5. Job safety positively influences technician's attitude towards the intentions of health and safety practices.

4. Coworker safety

Safety in the workplace/workshop plays an important role in workers well-being. This necessitates that colleagues at work will safeguard employees when the organization does not (Helmold, 2021; Pauly et al., 2021). Literatures show that coworkers have the prowess to influence employee attitudes and behaviour by providing safety information, affective support, and providing task-related help/assistance (M. Abbas et al., 2021; Zhu et al., 2022). Based on the safety information concept, coworkers provide information to their colleagues on the processes involved in carrying out a job task (Rese et al., 2022; Thoroughgood et al., 2022), when supervisors or safety managers are unavailable to oversee or observe employee behaviour at work (Islam et al., 2022; Neale & Gurmu, 2022). The interactions between coworkers involve sharing information about hazards and their concern for the safety of other workers. This implies that other coworkers can perform certain safety activities because some of their colleagues engage in the right way of carrying out a task or the proper use of person protective equipment (A. Ramos et al., 2020). Previous studies on coworker's safety had focused on coworkers support towards the improvement of safety policies and practices in the workplace/workshop (H. Lee, 2021; Norman & Ricciardelli, 2022), interaction (Mao et al., 2021), used as a moderator variable between supervisor feedback and innovative behaviour (Eva et al., 2019). Hence, this present study delved to ascertain the influence of coworker's safety on the constructs of TPB. Therefore, it was hypothesized that

H6. Coworker's safety positively influences technician's attitude towards the intentions of health and safety practices.

5. Supervisor's safety

Supervisors' competency and safety practices can contribute immensely to the safety behaviour of the workers and the organization (He et al., 2021; R. Shepherd, L. Lorente, M. Vignoli, K. Nielsen, & J. M. Peiró, 2021). The supervisor engages in continuous role-making processes and exchange of safety resources with the workers (McLarty et al., 2021; Okolie et al., 2021). The nature of the bond that exists between the workers and their supervisors predicts the extent of the outcomes to individual workers, department and organization (Hirschi & Spurk, 2021; Ivcevic et al., 2020). The basic principle of the supervisor-employee relationship is the quality of the interactions that affect the workers and the organization's attitude and behaviour towards health and safety practices in the workplace (Hatmaker & Hasan, 2021; Wu et al., 2021). As an agent in the organization, the supervisor serves as an intermediary between the organization and the workers (Ali et al., 2022; Jing et al., 2021; Sulbout et al., 2022). Therefore, enforced safety in the workplace might be a result of the supervisor's experience of the organization's safety culture, norms, health and safety practices (Probst et al., 2015). Likewise, the wrong safety behaviour exhibited by the supervisor may deter the employee safety attitude; hence, they exhibit wrong safety behaviour in the workplace.

Also, when supervisors suggest their view towards improving safety in the workplace, there is an improved workers perception about the organization's disposition towards safety. This perception will motivate the workers to participate in safety-related activities (Pourfalatoun & Miller, 2021; Rubel et al., 2021; Schwepker & Dimitriou, 2021). Also, inconsistently relating safety issue to the workers may lead to their unwillingness to communicate safety or be responsive to safety issues. The supervisor's safety knowledge is a key component in building safety practices among workers in the workplace. This knowledge include the use of safety facilities, managing incidence, training workers and understanding the safety conditions needed by workers to be efficient at work. Hence, it was hypothesized that

H7. Supervisor's safety negatively influences technician's subjective norms towards the intentions of health and safety practices.

H8. Supervisor's safety negatively influences technician's intentions towards health and safety practices.

6. Management of safety practices

Management of safety practices simply implies the activities, functions or roles linked with safety (B. Wang, 2021; Swuste et al., 2021). It is a mechanism integrated into the organization that is modeled to control hazards that can have an effect on workers' health and safety practices (Buniya et al., 2021; Mohandes & Zhang, 2021). Managing safety practices involves the organizations' management to implement policies and strategies, procedures and activities that will enhance the safety of their workers (Camilleri, 2021; J. Abbas & Kumari, 2021). The workers should be exposed to safety practices early and continuously to boost their safety culture and norms (Musonda et al., 2021; Vignoli et al., 2021) or rather stimulate them from unsafe behaviour into safe behaviour by reinforcement (Bemi et al., 2021; Oviedo-Trespalcacios et al., 2022) unlike safety training given to workers' at assumption of duty in the workplace where workers are expected to assimilate all safety briefings (Koo et al., 2014; Shen & Tang, 2018). In safety training, workers are made aware of the hazards and dangers which are specific to the workplace and are provided to foresee and predict accidents and injuries (Anasuya et al., 2020). Worker's first exposure to safety practices often occurs during a training session. As such, workers' perceptions regarding the quality and relevance of health and safety training received may determine the frequency and quality of involvement in a workplace safety and health practices (Bayram et al., 2022; Tetzlaff et al., 2021). When the management is committed to workplace safety by consistent providing safety training, organizing safety programmes (safety day, safety week and issuing an award to an outstanding personnel), providing PPE and safety equipment, will improve workers intentions to engage in health and safety practices (Ammad et al., 2021; Ebekozen, 2022; Man et al., 2021). Therefore, it was hypothesized that

H9. Management of safety practices positively influences technician's perceived behavioural control towards the intentions of health and safety practices.

7. Safety programme

Safety programme is also referred to as institutional safety climate in this study. It simply points to workers' cognizance of the institutions policies and practices as they relate to the values and essence of the safety culture within the institution (Ammad et al., 2021; Buniya et al., 2021). Safety culture is a wider component of the institution safety climate. It consists of attitude, belief and insights shared by the workers which in turn determine their norms and values, how they react and control risks (Bisbey et al., 2021; Tetzlaff et al., 2021). Safety climate is a specific form of organization' climate that describes worker's belief of the organizations' value of safety in the work environment (C. -F. Huang et al., 2021; Rispler & Luria, 2021). A robust institutions' climate will motivate workers to comply and participate in safety

activities. Complying with safety activities involves workers adherence to the procedures and ethics in which work is done while active participation in safety in the workplace helps co-workers to promote safety programmes, demonstrate initiatives and apply effort to improve safety (Bayram et al., 2022; Olsen et al., 2021).

In order to manage safety programme to yield low hazard casualties, it was suggested that institutions should consistently promote personnel, be involved in drafting safety policies and processes, carryout consistent training of workers, spell out achievable procedures for job placement and promotion, decisions concerning work practice, superior and supervisors’ training for new workers, mandates senior management officers to attend health and safety meetings, workers participation reward system, thorough investigation of accidents, hiring practices (Bridi et al., 2021; Hoque & Shahinuzzaman, 2021; Lornudd et al., 2021; Nobrega et al., 2021), ensure that safety bills/posters are displayed to identify hazards, daily briefing about health and safety in meeting and empowering the workforce, management commitment to communication and feedback as safety management practices in the workplace (Martin & Benson, 2021; Settembre-Blundo et al., 2021).

With several conscious efforts made by researchers to examine the influence of safety programme on many other constructs, as shown in figure 1, this present study hypothesized that

H10. Safety programme negatively influences technician’s perceived behavioural control towards the intentions of health and safety practices

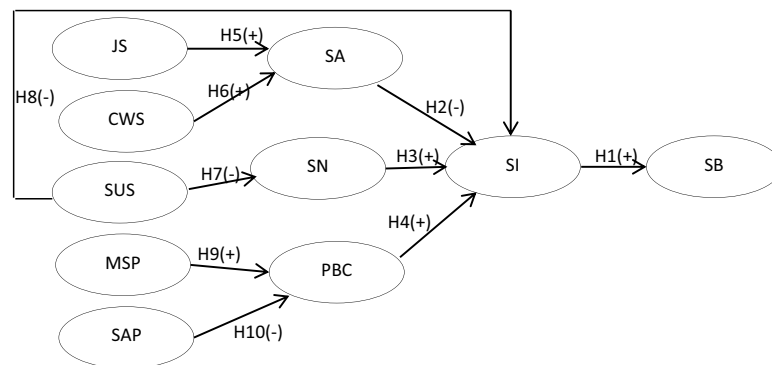
8. Methodology

The research instrument was administered to the registered technicians with Nigerian Association of Technologist in Engineering (NATE) through the association WhatsApp group. We recognize that the information gathered from the social media platforms represents the personal and private thought, feelings and behaviour of the respondents. An informed consent was obtained from the participants by stating the purpose of the data collection and how the data will be used in a section of the electronic version of the questionnaire. Therefore, absolute confidentiality of the data collected was assured.

9. Sample

A sample of 1,080 registered technicians are selected from different organizations in Lagos State, South-West region, Nigeria. Purposive sampling technique was used to select sample used in this study from 1,250 registered technicians in the year 2021–2022. The selected technicians are the duly registered members of NATE in Lagos zone. The sample size was obtained as a result of the

Figure 1. Research framework for hypotheses formulation.



SUS: Supervisor’s safety; CWS: Coworker’s safety; JS: Job safety; SAP: Safety programme; MSP: Management of safety practices; SA: Safety attitude; SN: Subjective norms; PBC: Perceived behavioural control; SI: Safety intentions; SB: Safety behaviour

filled e-copy of the instrument that was posted on the association social media platform. The data collection process took place within 2 weeks from the day the e-copy of the instrument was posted on their social media platform. The data collection exercise yields 86.4% response rate. The choice of the samples was because they had gone through technical training in technical colleges in Nigeria and specialized in various fields like mechanical engineering, electrical installation and maintenance work, plumbing and fittings, automobile repairs, radio and television repair. They are certified by National Business and Technical Examinations Board and by the government through trade test certification.

10. Instrument

The work safety and health instrument was measured by using work safety scale by Hayes et al. (1998) with five constructs (Supervisor safety, Coworker safety, Job safety, Safety programme and Management of safety practices), and the TPB model constructs was measured with NIOSH eight core competencies by Guerin et al. (2018). It measures the construct (attitude, subjective norms, perceived behavioural control and behavioural intentions) while an adapted scale (Doll & Torkzadeh, 1998) was used to measure actual safety behaviour. The scale contains seven items that was measured on a five-point Likert scale, where 5 is strongly agree and 1 is strongly disagree.

11. Results

The data collected went through preliminary data analysis to ascertain the quality of the data collected by carrying out some validity tests. First, the data were subjected to a reliability test using Cronbach alpha internal consistency for the variables; further test was conducted to ascertain the validity and reliability of the data. Confirmatory factor analysis was used to ascertain the outer loadings of the items of the instrument; therefore, any loadings below the threshold of 0.7 was deleted from further analysis. Also, the data collected went through convergent and discriminant validities where the strength of each variable is predicted.

The average variance extracted (AVE) and composite reliability (CR) are used to measure the convergent validity as used in previous research studies that investigated component analysis (Afework et al., 2021; Hair Joseph et al., 2016; Dos Santos & Cirillo, 2021). The constructs have a CR ranging from 0.849 to 0.909 which is a value above 0.7 (Hair Joseph et al., 2016). The AVE has a range between 0.55 and 0.83 which is adequate with a value beyond the 0.5 cut off (J. Hair et al., 2014).

The constructs internal consistencies ranges from 0.77 to 0.86 (Trizano-Hermosilla & Alvarado, 2016). The reliabilities of the measure variables represent the internal consistency the constructs which forms the CR. Therefore, a higher CR will result to a higher the internal consistency of the latent variables (Kalkbrenner, 2021).

Also, the discriminant validity was ascertained by the square root of the variance extracted as indicated in Table 1 and equated with the correlations between the constructs in Table 2. The comparison indicated that the correlation of the constructs is lower to the square root of the variance extracted in vertical and horizontal columns (Cheah et al., 2020; Dash & Paul, 2021). This shows that each construct forms a stronger link with its measure than other constructs. The result indicated that the data sufficiently predict the model since the validities measure up to the required thresholds.

12. Structural assessment model

The proposed model was estimated based on the recommendations of Ringle et al. (2015) using SEM-PLS. The outer loadings below 0.70 were removed due to their bestowal to the content validity (J. F. Hair et al., 2011). Figure 2 shows the measurement models with the outer loadings beyond the threshold value of 0.7. The R^2 -values determined the predicting ability of a model. So comparing R^2 -value and the paths coefficient is an indication that the data fits the model (Fye et al., 2022; Theiri & Alareeni, 2021). The R^2 -value for endogenous variables must be greater than or equal to 0.1 to be adequate and value below to be weak (Alakbari et al., 2022; Sanchez, 2021). In this study, the R^2 -values for the endogenous variables are less than 0.1 which indicates that the data does

Table 1. Validities and reliability coefficients

Constructs	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted (AVE)
Coworker's safety	0.782	0.945	0.869	0.69
Job safety	0.867	0.873	0.897	0.555
Management safety practice	0.843	0.867	0.895	0.682
Percieved behavioural control	0.787	0.801	0.859	0.605
Safety attitude	0.788	0.859	0.849	0.584
Safety behaviour	0.755	0.779	0.855	0.664
Safety intention	0.854	0.880	0.895	0.63
Safety programme	0.771	0.804	0.896	0.812
Subjective norms	0.823	0.729	0.894	0.809
Supervisor's safety	0.799	0.800	0.909	0.833

not adequately fit the model. Also, the standarized root mean square residual (SRMR) of 0.08 (Henseler, 2017) and a Normed Fit Index (NFI) ≥ 0.9 indicate a good model fit (J. Hair et al., 2010). The model fit index in this study yields an SRMR of 0.08 (Henseler, 2017). This means that the model provides a good approximation of the relationship among the variables in the model. However, the NFI value of 0.56 was obtained, which is quite low and suggests that the model has a poor fit to the data. Therefore, there is need for further investigation to determine the reasons for the poor fit.

The constructs cross-validation redundancy is adequate with Q2 value ranging from 0.076 to 0.453 (Rigdon, 2014) which indicates that inner model measures are predictive and relevant, and the lateral collinearity test (variance inflation factor) value ranges from 1.000 to 1.045 which is a value lesser than the threshold 3.3 (Hassandoust et al., 2022; Hayat et al., 2022). This is an indication that the data relating to the research model is non-indicative of collinearity. From Table 3, at 97.5% confidence interval, the hypothesis is accepted at a *t*-value of 1.96 and a *p*-value < 0.05 .

13. Discussion of the findings

This study focused on harmonizing work safety and health practices towards technician's productivity in the workplace using a modified TPB. The proposed model's level of fitness with the collated data was ascertained with different validity thresholds. To support previous literatures that used exploratory analysis, this study found out that work safety and health practice constructs have significant influence on technician's safety behaviour which further culminated into increased productivity, reduced wastage, prolonged machine or equipment life, and reduced accident. Also, this study shows that including the work safety scale to predict technician's performance resulted to a robust theoretical framework that could be adopted or adapted.

The result shows that safety intentions have positive significant influence on safety behaviour. This is an indicator that a technician with positive safety intentions in the workplace will definitely make safety a habit whether with or without adequate safety infrastructures. Therefore, hypothesis 1 is accepted. This outcome supports previous studies whose findings revealed that worker's safety behaviour is predicted by their intentions. It was further explained that the intentions to participate in safety behaviour is precursor to safety behaviour (Hinsz & Nickell, 2015; Ohanu et al., 2021; Shi et al., 2022; Dragan, Panait and Schin, 2021; Steinberg et al., 2021; Zaremohzzabieh et al., 2022). Likewise, the study agrees with the findings of some other literatures that safety behaviour in the workplace is as a result of significant influence of worker's safety intentions and

Table 2. Cross-correlation and discriminant validity of the constructs

Constructs	1	2	3	4	5	6	7	8	9	10
Coworker's safety	0.831									
Job safety	0.208	0.745								
Management of safety practices	0.13	0.145	0.826							
Perceived behavioural control	0.017	-0.079	0.2	0.778						
Safety attitude	0.123	0.317	0.218	0.016	0.764					
Safety behaviour	0.125	0.078	0.017	0.014	-0.05	0.815				
Safety intentions	-0.027	-0.09	0.054	0.159	-0.068	0.098	0.794			
Safety programme	0.058	-0.025	-0.076	-0.077	-0.059	-0.056	0.108	0.901		
Subjective norms	-0.034	0.073	-0.082	-0.033	-0.029	0.066	0.077	0.044	0.900	
Supervisor's safety	-0.04	0.117	0.025	0.019	0.071	-0.047	-0.12	-0.017	-0.102	0.913

methodologies adopted to carry out safety operations (Chou et al., 2022; de Saint Laurent et al., 2022; Doan et al., 2021; Sarmah et al., 2021; Liu & Keller, 2021).

Technician's safety attitudes had negative and insignificant influence on their intentions to engage in safety practices, this allowed hypothesis 2 to be rejected. The result diverge from the suggestions of some literatures where individual's attitudes have substantial relationship with their intentions (Hinsz & Nickell, 2015; M. -F. Chen & Tung, 2014; Mohammadfam et al., 2021; S. Wang et al., 2014; Xi et al., 2021). The study shows that poor positive technician's attitude will lead to poor safety intentions and an increased accident occurrence in the workplace and vice versa. In some organizations, workers' positive attitude is influenced by several exogenous variables like adequate remuneration, good working condition, adequate provisions of safety equipment, etc. Hence, this study suggests that technician's safety behaviour can improve when positive attitude is reinforced and negative attitude towards safety is punished. This implied that attitude factor influences workers safety intentions towards actual safety behaviour (H. Chen et al., 2021; Li et al., 2022; Liang et al., 2022; Q. Liu et al., 2020).

Technician's subjective norms had positive significant influence on their intentions to engage in safety practices; hence, hypothesis 3 is accepted. The result concurred with some previous literatures' result that aligned with the existence of a strong relationship between subjective norms and intentions (Adu-Gyamfi et al., 2022; Wong & Lee, 2016; Gu & Guo, 2022; Husain et al., 2021; Izquierdo-Yusta et al., 2022). This is an indication that the more social pressure from important people that matters and colleague cause technicians to engage safely in activities and behave safely in the workplace. Technicians who are influenced easily by other worker's safety performance have high tendencies to engage in safety behaviours (Liu, et al., 2019; Conradie et al., 2021; Lewis et al., 2021; Sullman et al., 2021; Tan et al., 2022).

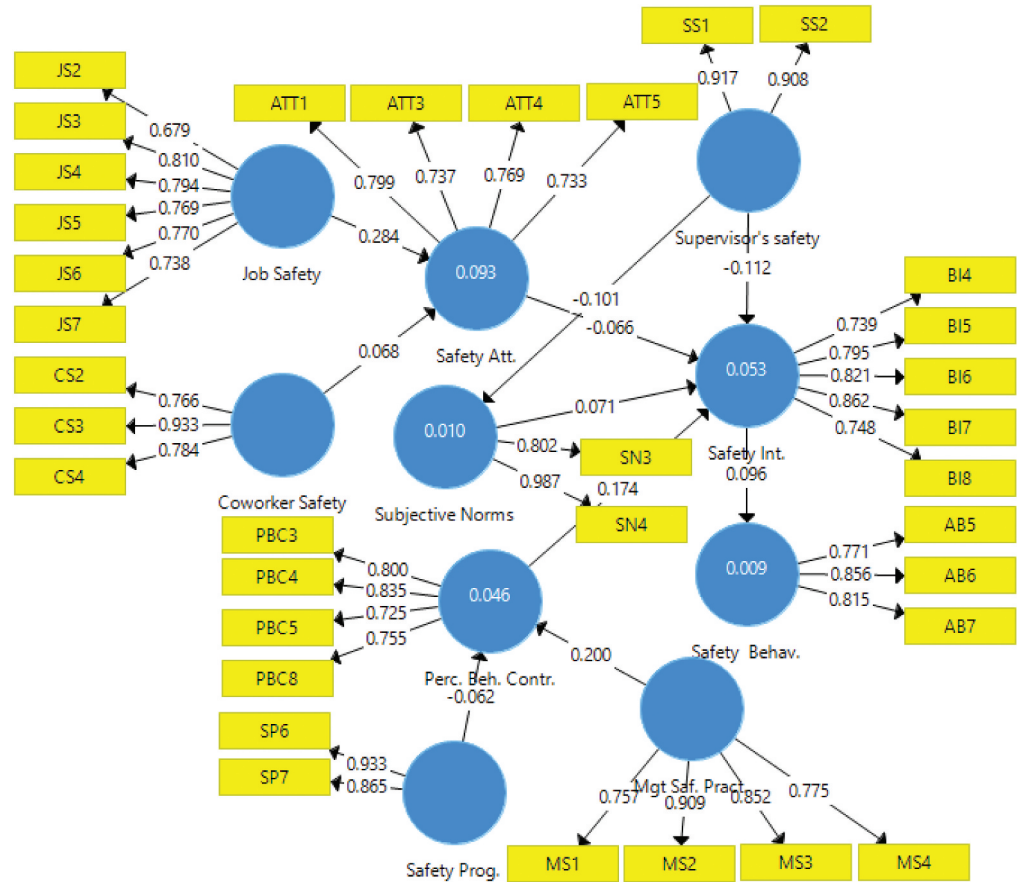
There is a positive significant prediction that technician's perceived behavioural control have influence on their safety intentions to engage in safety practices. Hence, hypothesis 4 is accepted. This result aligned with previous studies that predicted significant relationship between perceived behavioural control and intentions (Conradie et al., 2021; Gholamrezai et al., 2021; Guerin & Sleet, 2021; Zhang et al., 2021). The result suggested that technicians' are encouraged to adhere to safety practices through safety posters and postcards within and around the workshop. This geared a sustained relationship between their perceived behavioural control and their intentions to engage in safely behaviours (Lim & Weissmann, 2021; Ong et al., 2021; Zhao et al., 2021). Also, adequate provision and access to safety resources and opportunities will cause technician's to engage in safety practices (Liu, et al., 2019; Zhang et al., 2021; Pamidimukkala & Kermanshachi, 2021).

Job safety has positive significant influence on technician's attitude to build intentions to engage in safety practices. Hence, hypothesis 5 is accepted. The result of the finding concurs with previous literature that attitude has significant influence with its exogenous variables (Ghasemi et al., 2022; Tetzlaff et al., 2021). Ohanu and Shodipe (2021) in their findings established significant relationship between several exogenous variables and students entrepreneurial attitude towards their intentions to behave entrepreneurially. Similarly, this is an indication that when technicians perceive the safe nature of work or work climate, they exhibit positive attitude and sustained intentions to engage in safety practices. It was suggested in literatures that job safety is predominantly influenced by poor management, poor supervisory roles, poor working environment, stress and physical workload and directly or indirectly affect technician safety attitude in the workshop (Kalteh et al., 2021; Wong et al., 2021; Ünal et al., 2021).

Also, coworker's safety lifestyle and consciousness had positive significant influence technician's attitude towards their intentions to engage in safety practices. Therefore, hypothesis 6 is accepted. It is no doubt the extent to which coworkers can influence other colleagues in the workplace, since they are experts in their field of specialization. On the job, coworkers share more time to discuss their experiences, up-to-date information about safety and recent safety discoveries with others within their unit/department and sometimes outside their unit than the manager and supervisor

Figure 2. Estimated hypothesized safety model.

CS, coworker's safety; JS, job safety; ATT, safety attitude; SS, supervisor's safety; BI, safety intentions; AB, safety behaviour; MS, management safety practices; SP, safety practices; PBC, perceived behavioural control; SN, subjective norms.



(Lee et al., 2021; Zhao et al., 2021). Also, the coworkers have significant influence on the productivity of their workgroup more than the supervisor (Dodoo et al., 2021; M. Abbas et al., 2021; Zhu et al., 2022). The coworkers' approach to improving safety behaviour has yielded several positive outcomes. It is easy for coworkers to approach and correct their members engaging in an unsafe behaviour; therefore, the continuous corrections will lead to actual safety behaviour (Gu & Guo, 2022; Liang et al., 2022; Nguyen-Phuoc et al., 2022). It was suggested that when certain worker's safety expectations are met in the workplace (e.g. good service/working condition, management climate, supervisory roles, safety equipment, remuneration) that gives a sense of fulfillment, coworkers can exhibit more positive behaviour (Xu et al., 2021; Danso et al., 2022; Newaz et al., 2019).

There exist negative significant relationship between supervisor's safety and technician's subjective norms towards their intentions to engage in safety practice. Therefore, hypothesis 7 is accepted. In previous studies, supervisors have played important roles that create certain work conditions that give high priority to positive safety behaviour. These work conditions can be created when supervisors lay much emphasis to the workers the right ways to carry out a work task safely. Also, there exist support for technicians' social norms towards safety intentions and compliance towards positive safety behaviour as supervisors place high priority to safety (Khalid et al., 2022; Mohajeri et al., 2022; Obrenovic et al., 2022; Liu et al., 2021). This shows that supervisor's safety beliefs have a high tendency to influence technician safety compliance. Literatures affirmed that an important factor that motivate technician's to work safely is the knowledge of the supervisor's safety management roles, that is, the ability to enforce proper use of safety infrastructures provided by the management (Liu et al., 2022; Shepherd, Lorente, Vignoli, Nielsen, & Peiró, 2021; Yang et al., 2022).

Table 3. Hypothesis testing and path coefficient

Hyp	Model path	Coeff.	Std error	Confidence interval		t-Value	p-Value	Decision
				2.50%	97.50%			
1	Safety Int. -> Safety Behav.	0.096	0.031	0.047	0.163	3.119	0.002	Accepted
2	Safety Att. -> Safety Int.	-0.066	0.038	-0.140	0.007	1.753	0.080	Unaccepted
3	Subjective Norms -> Safety Int.	0.071	0.036	0.005	0.140	1.981	0.048	Accepted
4	Perc. Beh. Contr. -> Safety Int.	0.174	0.032	0.112	0.234	5.477	0.000	Accepted
5	Job Safety -> Safety Att.	0.284	0.024	0.243	0.338	11.717	0.000	Accepted
6	Coworker Safety -> Safety Att.	0.068	0.024	0.028	0.121	2.850	0.005	Accepted
7	Supervisor's safety -> Subjective Norms	-0.101	0.030	-0.161	-0.049	3.411	0.001	Accepted
8	Supervisor's safety -> Safety Int.	-0.112	0.027	-0.168	-0.059	4.114	0.000	Accepted
9	Mgt Saf. Pract. -> Perc. Beh. Contr.	0.200	0.029	0.146	0.258	6.969	0.000	Accepted
10	Safety Prog. -> Perc. Beh. Contr.	-0.062	0.036	-0.137	-0.007	1.757	0.079	Unaccepted

Supervisor's safety competency, knowledge/skills and safety practices at the workplace had negative significant influence technician's safety intentions to engage in safety practices. Hence, hypothesis 8 is accepted. This study extended previous studies where supervisor's safety practices and worker's participation in the use of safety equipment are significant (Almeida et al., 2022; Gilmartin et al., 2022; Houette & Mueller-Hirth, 2022; Midtlyng, 2022). This safety habit had risen from several built-up of worker's intentions to use the safety equipment over time. Also, some previous literatures found that supervisors' safety role in the workplace conveniently predict workers turnover intentions in healthcare setting and workers' safety intentions at different supervisory conditions (Chong et al., 2022; Heyns et al., 2021; Paek et al., 2022; Neto et al., 2021; Turner et al., 2020; Zaheer et al., 2019).

Management safety practices and technician's perceived behavioural control have positive significant relationship. Hence, hypothesis 9 is accepted. This result suggests that adequately managed safety activities have fierce influence on workers' perceived behavioural control to engage in safety practices (Liang et al., 2022; S. Lewis et al., 2022; Zielińska-Tomczak et al. (2021). Some previous literatures ascertained that both management commitment to safety activities and workers' involvement in safety practices can boost the health and safety lifestyle in the workplace. This lifestyle can be achieved by technician's attending programmes, observing safety activities as it is established in the workplace and management building up a working and quality safety systems and policies (Ijioma et al., 2021; J. Liu et al., 2022; Koskan et al., 2021; M. Ramos & Martinho, 2021).

Safety programme (training, safety seminar and orientation programmes) and technician's perceived behavioural control are negatively and insignificantly related. This made hypothesis 10 to be rejected. The result is contradictory to some previous findings where technicians perceived the importance of the use of safety equipment, habit and safety practice after they had gone through several programmes like safety training, seminar and safety orientation programme, etc.; hence, accident is reduced to the barest minimum in the workshop (Meyer et al., 2019; Perrin et al., 2018). It was suggested that technician's perceive that the ability to comply with safety activities or safe work ethics is attributed to varying factors within their personal control (Wong & Lee, 2016; Perrin et al., 2018). This occurs when their perceived behaviour control is influenced by other exogenous factors within the institution. Huang et al. (2021) suggest that the core steps to prevent hazard is to improve technician's safety knowledge and the implications of exposure to hazards and several ways control hazards in their workplaces. Some literatures suggest that safety training is one of the major factors that can improve technician's safety lifestyle, climates, safety intentions, safety compliance and safety behaviour (Loosemore & Malouf, 2018; Mkpate et al., 2018; Rodríguez-Garzón et al., 2015; Swuste et al., 2021).

14. Theoretical implications

The result of the study has shown the robustness of TPB model. It points to the extent to which TPB could be modified; hence, the findings from this study align with the suggestions of some literatures that exogenous variables have positive or negative and significant or non-significant influence on the constructs of TPB. Previous literature shows the necessity to modify TPB model; this could be done by adding a single or more constructs while some others extended TPB with the constructs of other theoretical framework (Liu et al., 2022; De Lauwere, et al., 2022). Hence, the study formulated a safety model that could be adopted by health and safety experts and expanded in future research. Also, this present study presents results that suggest a moderate prediction between the TPB model and technician's safety intention, actual safety behaviour and the continuous health and safety practice among technologist, learners and everyone engaged in the workshop. It is possible that the supervisors, coworker, safety managers and organization play important roles to motivate technicians to practice safety in the workplace (Koo et al., 2014).

15. Practical implications

In practice, this study provides a framework that curriculum developers can adopt. The study can change student's knowledge, perception and behavioural intentions to engage in safe and healthy activities. Hence, school based occupational safety and health education may contribute to future

reduction in job-related injury, to ensure that safe and healthy work becomes important to the students experience. School teachers and/or instructors are safety role models and implementers of curriculum that should encourage the learners by engaging in positive safety behaviour, organizing safety activities like safety week, having safety instructional materials in the school workshop like a bill board on the walls showing safety tools and equipment, safety rules and regulations and instructions on machine usage and maintenance. The educational institutions should adopt a free foundational curriculum in workplace safety and health that provide students with various safety contents that expose the institutions to several researches on the vital roles that educational institution can play to prepare the future workforce for safe and healthy employment.

16. Conclusions

The study investigated harmonizing work safety and health practices towards technician's productivity in the workplace: a modified TPB. This nature of research is rarely conducted in developing and underdeveloped countries. The TPB model was adopted to give theoretical direction in this study. The result revealed that the constructs of work safety and health practices significantly influence technician's safety behaviour and led to an increased productivity. The result revealed that technician's safety intentions have positive significant influence on safety behaviour. Also, technician's safety attitude had negative and insignificant influence on their intentions to engage in safety practices. Technician's subjective norms had positive significant influence on their intentions to engage in safety practice. Furthermore, technician's perceived behavioural control positively influence their safety intentions. Coworker's safety lifestyle had positive significant influence on technician's attitude. Supervisor's safety had negative significant relationship with technician's subjective norms. Supervisor's safety competency, skill and safety practices had negative significant influence on technician's safety intentions. Safety programmes had negative and insignificant influence on perceived behavioural control. The study had theoretical and practical implication that enhance the TPB and provided a framework that safety curriculum developers can adopt. Despite the numerous benefits accrued, the study experienced some limitations. The result of the findings may not be generalized because of the sample size which is a fractional part of the population in the region. Also, the proposed model may not be functional in all organizations because of the ranging variance in the organizational policies, challenges and influences of government policies as it affect the establishment and operations of the industries. Some of the challenges attributed in the study may be peculiar to industries in developing countries like Nigeria, while challenges in developed and underdeveloped countries may differ based on their level of development.

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