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Communication's Role in Safety Management and Performance of the Road Safety Practices

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ABSTRACT

Workers' road safety in organizations represents a major issue in countries like France, especially when considering the large number of vehicles used in displacements assigned by companies. Despite continuing efforts to reduce the number of crashes, every year thousands of workers found death in their workplaces and millions suffer occupational injuries and illnesses. The communication in organizations could play an important role to increase road safety. To better know its role, this study measured managers' and employees' perceptions about the communication's role in six antecedents' safety management and performance of road safety practice self-reported safety knowledge, safety motivation, safety compliance and safety participation, by conducting a survey using a questionnaire among 165 employees and 135 managers.

The reliability and unidimensionality of all the items of scale used were found acceptable. Path analysis using AMOS-19 software showed that some of the safety management of road safety practices have effects associated with the safety performance determinants and components; namely, all the six antecedents' only safety training and safety promotion have effects related to safety motivation, and only safety commitment, safety communication and feedback have effects related to safety knowledge. Safety behavior compliance was found to be the key mediator in explaining these effects and relationships, and only safety feedback has effects related to safety participation. Safety feedback was identified as the most important safety management factor to road safety practices that predicts safety knowledge, safety motivation, safety compliance and safety participation.

The results of this study will contribute to the related companies' ability to assess the road safety indicators and will also be a contribution to the future development of safety performance management for road safety practices in companies.

KEYWORDS: Safety communication, Safety performance, Safety management, Safety behavior, Road safety practices.

INTRODUCTION

Despite continuing efforts to reduce the number of work-related accidents, every year thousands of workers die at their workplaces and millions suffer occupational injuries and illnesses (U.S. Bureau of Labor Statistics [BLS], 2008a, 2008b). In fact, there were 1178 fatal work injuries in the United States (U.S.) construction industry sector in 2007 (BLS, 2008c). Furthermore, the costs associated with injuries in the U.S. construction industry have been estimated to exceed 10 billion dollars per year (Waehrer et al., 2007). Over the past few years, the road crashes are one of the most important problems faced by many

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organizations in several countries. In France, statistics of road crashes (French Interior Ministry, 2009) revealed a number of 53 014 road crashes, 1997 people lost their lives, 44109 were injured and 16 173 hospitalized. According to these statistics, what can companies do to maintain the employees' safety?

According to the manual prepared by (Delhomme et al., 2009), road safety communication campaigns aim at:

- Providing information regarding new or modified legislation.
- Increasing knowledge and awareness as the impact of new technology, equipment, as well as behavior on the road and associated risks are concerned.
- Changing the parameters that have scientifically or empirically proven to affect road user behavior (Ajzen, 1985).
- Attempting to change inappropriate behavior that increases risk and retaining behavior that promotes safety.
- Contributing to the reduction of the frequency of road accidents and the minimization of severity of their impacts.

In fact, researchers and practitioners have gradually recognized the importance of organizational factors, such as safety climate, for safety performance in the construction industry (Mohamed, 2002).

Most of the authors (Bowander, 1987; Chouhan, 2005; Gupta, 2002) who studied the accidents unanimously agreed that programmes and policies for managing safety in the workplace in major industries in different countries are inadequate and require modification. The communication in organizations is used as a rather efficient strategy to approach the wide audience in terms of promoting road safety, improving driving behavior and contributing to less road accidents, injuries and fatalities (Conner and Norman, 2005; Marcil et al., 2001).

Research in the area of road safety became prominent during the past three decades. Its primary objective is to predict safety related outcomes such as accidents and injuries in order to provide valuable guidance for improving safety in organizations. This requires extensive knowledge, not only about the various aspects that influence safety, but also as to how these influences occur. The fact that organizational and social factors do influence safety performance led to extensive research in the field of safety culture and safety climate (e.g., Cox and Flin, 1998; Donald and Canter, 1994; Glendon and Stanton, 2000; Guldenmund, 2000; Hofmann et al., 1995; Lee and Harrison, 2000; Mearns et al., 2003; Pidgeon, 1998; Vinodkumar and Bhasi, 2009; Zohar, 1980).

Neal et al. (2000) took safety climate as a single factor containing management values, communication, training and safety systems and studied the mediating role of safety knowledge and motivation on the relationship between safety climate and safety behavior. SEO (2005) operationalized perceived safety climate as management commitment, supervisor support, co-worker support, employee participation and competence level in the study looking for mediators in safety climate-safety performance relationship. Huang et al. (2006) included management commitment to safety, return to work practices, post-injury administration and safety training as the constituents of safety climate while analyzing the mediating role of safety control in the relationship between safety climate and safety performance.

Siu et al. (2004) took safety attitudes and communication as the factors in safety climate while assessing the mediating role of psychological strain in the safety climate-safety performance relationship. In another study, Wu et al. (2008) opined that safety climate consists of CEO's safety commitment, managers' safety commitment, employees' safety commitment, emergency response and perceived risk.

In the study of Cavazza and Serpe (2009), the mediating role of attitudinal ambivalence of employees towards personal protective equipment in the relationship between safety climate and unsafe behavior was investigated. This study considered company safety concern, senior managers' safety concern, work pressure and supervisors' attitude

towards safety as the dimensions of safety climate. It is evident from these studies that the choice of safety climate dimensions can partially be determined by practical interest (Huang et al., 2006). In light of the research presented above, it is argued that construction workers who feel more comfortable to raise and discuss safety issues with their supervisors are more likely to initiate and engage in such communication, and thus become more competent in safety procedures and policies, as well as more aware of the consequences of unsafe behaviors and of potential workplace hazards (Hofmann and Morgeson, 1999; Parker et al., 2001). As Parker et al. (2001) state, "one way in which good quality communications allow employees to behave safely is to provide them with the information they need to work safely". In summary, the perceptions of managers and employees of road safety practices implemented in their organizations are considered as organizational factors which can influence safety performance. Hence, the above six safety management on road safety practices are considered antecedents of safety performance in this study.

Safety Performance

Even though traditional measures of safety performance rely primarily on some form of accident or injury data, safety-related behaviors such as safety compliance and safety participation can also be considered components of safety performance. Safety compliance represents the behavior of the employees in ways that increase their personal safety and health. Safety participation represents the behavior of employees in ways that increase the safety and health of co-workers and that support an organization's stated goals and objectives (Hagan et al., 2001). The model proposed by Neal and Griffin (1997) based on the theories of job performance (Borman and Motowidlo, 1993; Campbell et al., 1993) distinguishes between the antecedents of performance, determinants of performance and components of performance.

Neal et al. (2000) considered safety climate an antecedent of safety performance, safety knowledge and safety motivation as determinants of safety performance and considered safety compliance and safety participation components of safety performance. In another study, Pousette et al. (2008) measured safety motivation and safety knowledge as two individual attitudes to safety. Self-rated safety behavior was measured by three safety behavior measures. They were named structural safety behavior (concerning participation in organized safety activities), instructional safety behavior (concerning safety activities in the daily work in interaction with co-workers and management) and personal safety behavior (measuring behavior promoting personal protection). Considering the above studies, the authors included the perceptions of the employees on the six identified safety management practices as the antecedents of safety performance in the current study. The determinants of safety performance were measured by safety motivation and safety knowledge, and components of safety performance were measured by safety compliance and safety participation in this study.

Safety Communication

It has long been recognized that open communication and frequent interaction between employees and supervisors are important organizational characteristics, which differentiate companies with low accident rates from those with high accident rates (e.g., Cohen et al., 1975, cited in Zohar, 1980; Smith et al., 1978). More recently, Barling and Zacharatos (1999) proposed information sharing and communication among 10 work practices which have positive impact on occupational safety.

At present, a significant body of research exists in support of the relationship of safety communication with various indicators of safety performance. For example, Bentley and Hale (2003) identified safety communication between managers and employees as one of five desirable management safety practices which differentiated between low and high accident rate postal delivery offices.

Other researchers have confirmed the negative relationship between safety communication and occupational accidents, injuries or near-misses (e.g.,Hofmann and Morgeson, 1999; Mearns et al., 2003; Mearns et al., 1998; Probst, 2004; Sawacha et al., 1999; Siu et al., 2004). Research has also indicated that safety communication was significantly associated with safety behavior such as compliance (Cheyne et al., 1998; Griffin and Neal, 2000; Parker et al., 2001), safety knowledge (Probst, 2004; Griffin and Neal, 2000), safety participation (Griffin and Neal, 2000) and success of safety programs (Harper et al., 1997). In three intervention studies, Zohar and Luria (2003) demonstrated that as supervisors' interactions with workers about safety issues increased, so did workers' safety behaviors and their safety climate perceptions. Consistent with this, other studies have shown that the most effective supervisors displayed a more supportive style of leadership, initiated discussion about safety and provided constructive feedback to workers about safety behavior (Mattila et al., 1994; Niskanen, 1994; Simard and Marchand, 1994).

The Present Study

The role of communication in employees' performance is critical because behaviors resulting in industrial accidents are not typically new occurrences (Vredenburgh, 2002). It is important to provide employees with risk identification and safety information through safety communication and replying quickly to safety related problems. In order for organizations to foster a climate where employees are alert to hazards, they must provide and communicate risk and safety information (Pidgeon, 1991; Fernandez-Muniz et al., 2007). Regular feedback on safety performance can be communicated to employees through posted charts and a review of behavioral data at safety meetings (Rundmo, 1994). Hoffmann and Stetzer (1998) found that safety communication significantly influences accident attributions.

This study was designed based on the findings of Campbell et al. (1993) that the six antecedents' safety management of road safety practices (commitment, training, involvement, feedback, procedures, promotion) mediate the relationship between the determinants and components of performance. The first purpose of this study was to establish the unidimensionality and reliability of the six safety management of road safety practices scales, safety knowledge, safety motivation, safety compliance and safety participation. The second purpose of this study was to investigate the direct effects of safety knowledge and motivation on the relationship between the six antecedents'safety management of road safety practices and safety behavior (safety compliance and safety participation). The hypothesized model of the study is depicted in Fig. 1.

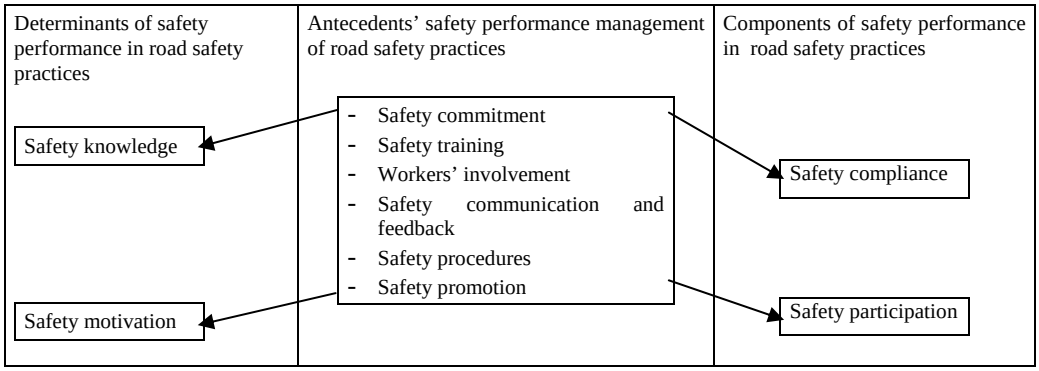

Figure (1): Hypothesized model

The safety management system implemented in an organization is comprised of a set of policies and practices aimed at positively impacting on the employees' attitudes and behaviors with regard to road risk, thereby reducing their unsafe acts.

Its aim is to raise awareness, understanding, motivation and commitment among workers (Fernandez-Muniz et al., 2007). From the above arguments, it appears that the safety management managers' practices can influence the safety knowledge and motivation of employees. Based on the above, the following hypotheses are advanced.

H1: Communication's role with foremen is expected to be positively related to a direct relationship between the six antecedents' safety management of road safety practices (safety commitment, safety training, workers' involvement, communication and safety feedback, safety procedures, and safety promotion).

H2: The six antecedents' safety management of road safety practices (safety commitment, safety training, workers' involvement, communication and safety feedback, safety procedures, and safety promotion) predict safety knowledge.

H3: The six antecedents' safety management of road safety practices (communication and safety commitment, safety training, workers' involvement, communication and safety feedback, safety procedures, and safety promotion) predict safety motivation.

H4: The six antecedents' safety performance management of road safety practices (communication and safety commitment, safety training, workers' involvement, communication and safety feedback, safety procedures, and safety promotion) predict safety behavior compliance.

H5: The six antecedents' safety performance management of road safety practices (communication and safety commitment, safety training, workers' involvement, communication and safety feedback, safety procedures, and safety promotion) predict safety participation.

METHOD

Population and Sample

This study was conducted in the year 2011 on French organizations.

Data collected for this study was based on a questionnaire survey. A questionnaire was sent to 750 managers and workers. A total of 300 usable questionnaires were collected, which represented 165 workers and 135 managers (40%) of the target sample. Details about the six companies that were studied are presented in Table 1.

Table 1. Details of organizations and response rate

		Questionnaire survey details		
	Participating organizations	**Given**	**Returned**	**Response%**
1	Colas Group (Paris)	400	150	38
2	PSA Peugeot Citroën (Eure-et-Loir)	100	55	55
3	La Plaine de l'Ain (Lyon)	100	40	40
4	MEDEF (Eure-et-Loir)	50	20	40
5	ANAIS (Eure-et-Loir)	50	20	40
6	ALVE (Eure-et-Loir)	50	15	30
	Total	750	300	40

We will try to give profiles of the respondents (N = 300), such as: (the mean of age, the rate of job

experience, the rate of difference between gender, the mean of marital status, the rate of kilometers of annual displacements by the participants, the rate of the driver's license experience, and finally the rate of job category). Details about participants' demographics are shown in Table 2.

Table 2. Profiles of respondents (N =300)

Characteristics		**Percentage %**
Age	(20-25) years	5.7
	(25-30) years	18.6
	(30-35) years	30
	(35-40) years	15.7
	(40-45) years	18.6
	(45-50) years	8.6
	(50-55) years	2.9
Job experience	(1-5) years	8.6
	(5-10) years	44.3
	(10-15) years	18.6
	(15-20) years	24.3
	(20-25) years	4.3
Gender	Male	62.9
	Female	37.1
Marital status	Single	4.3
	Married	95.7
Annual Kilometers	Less than 5000 km/an	5.7
	Between 5 000 and 9 999 km/an	10
	Between 10 000 and 14 999 km/an	5.7
	Between 15 000 and 19 999 km/an	24.3
	Between 20 000 and 24 999 km/an	25.7
	Between 25 000 and 30 000 km/an	4.3
	More than 30 000 km/an	24.3
Driver's license experience	(1-5) years	10
	(5-10) years	17.1
	(10-15) years	31.4
	(15-20) years	20
	(20-25) years	15.7
	(25-30) years	5.7
Job category	Manager	28.6
	Worker	71.4

Survey Instrument

The questionnaire contained 28 questions to measure the perceptions of the managers and employees about the six safety management of road safety practices, 8 questions to measure the participants' level of safety knowledge and safety motivation and 8 questions to measure self-rated safety compliance and safety participation. This was prepared based on a review of related literature and theory. It contained questions covering areas of safety communication in management commitment (4 items), safety training (4 items), workers' involvement (4

items), safety communication and feedback (4 items), safety procedures (4 items), safety promotion (4 items), safety knowledge (4 items), safety motivation (4 items), safety compliance (4 items), safety participation (4 items).

The content and substance of most of these 40 questions were taken from previous questionnaires of Vinodkumar and Bhasi (2009, 2010), Cheyne et al. (1998), Cox and Cheyne (2000), Coyle et al. (1995), Flin et al. (2000), Glendon and Litherland (2001), Neal et al. (2000), Varonen and Mattila (2000), Vredenburgh (2002), Williamson et al. (1997), Zohar (1980).

The scales were further developed by including complementary additions of new items, and some items were reworded and rephrased to suit local working road practices and culture. Care was taken to maintain the conceptual meaning of the scales close to the operationalizations made by Cheyne et al. (1998) and Neal et al. (2000). The contents of this draft questionnaire were discussed with senior researchers on road safety and professionals from the French Institute of Sciences and Technology for Transport, Development and Networks (IFSTTAR), as well as senior professors at the Laboratory of Driver Psychology (LPC) to ensure face validity. After considering each item in detail, necessary changes were made by simplifying, rewording, removing and replacing some of the items. The reliability and correlations were examined and those items with item-to-total correlation below 0.4 were dropped from the survey instrument.

Data Analysis

Descriptive statistics and correlations of the studied variables were first analyzed. Confirmatory factor analysis was used to verify the unidimensionality and reliability of the six antecedents'safety management of road safety practices (safety commitment, safety training, safety communication and feedback, workers' involvement, safety rules and procedures and safety promotion policies), two determinants of safety performance (safety knowledge and safety motivation) and two components of safety performance (safety compliance and safety participation). Structural equation modelling (SEM) techniques were used to conduct path analysis to test the hypotheses and the goodness of fit of the various models. AMOS-19 software was used for CFA and path analysis. The remaining analyses were conducted using SPSS-19 software.

Table 3. Means, standard deviations and correlations of the measures

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
COM	4.22	0.43										
TRA	4.23	0.59	0.59**									
INV	3.7	0.72	0.59**	0.63**								
FEED	4.45	0.39	0.15	0.18	-0.02							
PROC	4.52	0.29	0.27*	0.28*	0.54**	0.47**						
PROM	3.52	0.49	0.61**	0.73**	0.72**	0.44**	0.59**					
KNO	4.37	0.35	0.69**	0.43**	0.53**	0.51**	0.57**	0.68**				
MOT	4.63	0.49	0.52**	0.37**	0.83**	-0.16	0.60**	0.53**	0.56**			
COMP	4.41	0.33	0.48**	0.26*	0.53**	0.60**	0.83**	0.50**	0.74**	0.57**		
PAR	4.47	0.44	0.23*	0.46**	0.56**	0.55**	0.73**	0.70**	0.54**	0.39**	0.61**	-

** Correlations significant at $p < 0.01$.

* Correlations significant at $p < 0.05$.

Abbreviations: commitment (COM); training (TRA); involvement (INV); feedback (FEED); procedures (PROC); promotion (PROM); knowledge (KNO); motivation (MOT); compliance (COMP); participation (PAR).

RESULTS

Table 3 contains the means, standard deviations and inter-correlations of all the measures. There are significant negative correlations between the six safety management of road safety practices and self-reported road crashes data indicating the role of communication in safety performance management of road safety practices and the reduction of road crashes.

All the six antecedents'safety management practice scores have significant positive correlations with the six antecedents' safety management of road safety practices, suggesting support for hypothesis H1. Moreover, both safety motivation and safety compliance showed significant positive correlations with the six antecedents' safety management of road safety practices, suggesting support for hypotheses H3 and H4.

Unidimensionality Analysis

Unidimensionality refers to the existence of a single construct/ trait underlying a set of measures (Hair et al., 1998). Removal of items that reduce unidimensionality helps to solve the problems associated with unidimensionality. An instrument can be fine-tuned in this manner. Individual items in the model are investigated to see how closely they represent the same construct. A Comparative Fit Index (CFI) of 0.9 or higher for the model implies that there is strong evidence of unidimensionality (Byrne, 1994; Issac et al., 2006). The unidimensionality of the instrument used in the current study was tested by computing CFI values for all the measures. The results are shown in Table 4. Most of the CFI values were found to be above 0.95 satisfying the more stringent criteria put forward by Hu and Bentler (1995), demonstrating strong unidimensionality for all the scales.

Table 4. Results of confirmatory factor analysis: unidimensionality and Reliability coefficients

No.	safety management measure	No. of items	Comparative Fit Index (CFI)	Cronbach's alpha (α)
1	Safety commitment	4	0.96	0.43
2	Safety training	4	0.99	0.70
3	Workers' involvement	4	0.95	0.78
4	Safety communication and feedback	4	0.98	0.75
5	Safety procedures	4	0.99	0.59
6	Safety promotion	4	0.94	0.55
7	Safety knowledge	4	0.99	0.63
8	Safety motivation	4	0.97	0.74
9	Safety compliance	4	0.99	0.56
10	Safety participation	4	0.98	0.52

Reliability Analysis

Unidimensionality alone, though a necessary condition, is not sufficient by itself to establish the usefulness of a scale. Once unidimensionality is substantiated, its 'statistical reliability' should be assessed before it is subjected to any further validation analysis (Sureshchander et al., 2001). Even a perfectly unidimensional (and otherwise construct validity) scale would be rendered futile if the resultant aggregate score is ascertained basically by measurement error, with the values of the scores broadly fluctuating over repeated measures (Gerbing and Anderson, 1988). Reliability is defined as the proportion of observed score variance that is attributable to true score variance. There are several methods to establish the reliability of a measuring instrument, and the internal consistency

method is the most commonly used method in studies with cross-sectional design. The internal consistency is estimated using a reliability coefficient called Cronbach's alpha (α) (Cronbach, 1951). A value of 0.70 or above is considered to be the criterion for demonstrating strong internal consistency of established scales (Nunnally, 1978). In the case of exploratory research, a value of 0.60 or above is also considered as significant (Hair et al., 1998). Reliability analysis revealed that all of the six antecedents'safety management of road safety practices, two determinants of safety performance and two components of safety performance have good reliability suggesting that the survey items were appropriate indicators of their respective constructs.

Path Analysis

Path analysis has been conducted using the AMOS-19 program to test the hypotheses advanced. The hypothesized model shown in Fig. 2 was tested first. The present study used a set of different types of fit measures (Hair et al., 1998; Hoyle, 1995; Kline, 1998) such as, Chi-square values (χ^2), Comparative Fit Index (CFI), Bentler–Bonnett Fit Index (NFI), Tucker–Lewis Fit Index (TLI) and root mean square error of approximation (RMSEA) to determine the goodness of fit of a model.

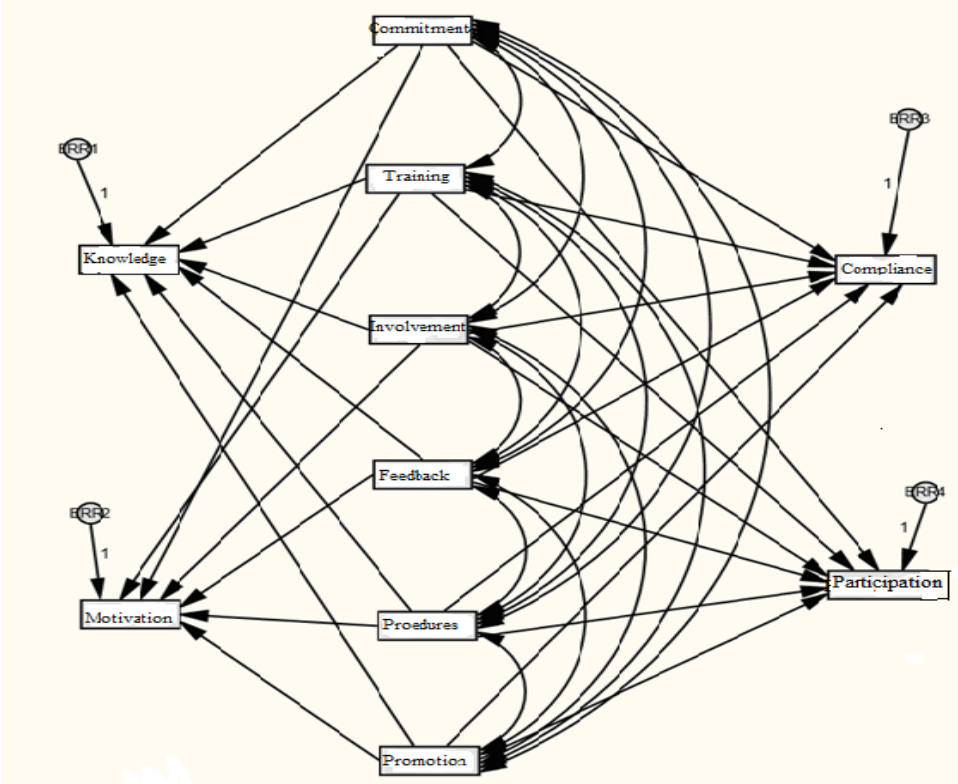

Figure (2): Proposed causal model of relationships between influencing factors

The recommended values for CFI, NFI and TLI are higher than 0.9 and RMSEA values less than or equal to 0.04 for good model fit (Hu and Bentler, 1999). A non-significant Chi-square indicates that the hypothetical model fits the data. Table 5 shows the fit indices of the hypothesized and modified models. The direct relationships of the six antecedents'safety management of road practices with safety performance components were tested. Results show that safety commitment, safety communication and feedback

predicted both safety knowledge and safety commitment. Safety communication and feedback, workers' involvement, safety rules and procedures predicted safety motivation. Furthermore, safety commitment, safety communication and feedback, workers' involvement, safety rules and procedures, and safety communication and feedback predicted safety participation. However, the remaining path coefficients were non-significant. Moreover, both TLI and RMSEA values were below the acceptable limits indicating that the model does not fit the data adequately. Model modification was carried out using model trimming procedure by deleting the paths with non-significant path coefficients, The results given in Table 5 show that Chi-square has become non-significant ($\chi 2$/ d.f.), $p<0.001$, CFI = 0.98, NFI = 0.98, TLI= 0.97, RMSEA< 0.08, indicating good model fit.

Table 5. Model specification and fit indices

Model	Feature	χ^2	d.f.	p	CFI	NFI	TLI	RMSEA
1	With all direct paths	204.3	14	<0.001	0.82	0.80	0.85	0.14
2	FOR↔COM direct path added	130.7	17	<0.001	0.98	0.98	0.98	0.05
3	COM↔INV direct path added	150.6	13	<0.001	0.97	0.98	0.96	0.04
4	COM↔PROM direct path added	170.6	13	<0.001	0.98	0.98	0.97	0.05
5	FOR↔INV direct path added	120.7	13	<0.001	0.98	0.98	0.98	0.06
6	FOR↔PROM direct path added	144.9	17	<0.001	0.96	0.98	0.96	0.07
7	INV↔PROC direct path added	170.7	15	<0.001	0.98	0.98	0.98	0.05
8	INV↔PROM direct path added	178.3	13	<0.001	0.98	0.98	0.97	0.06
9	FEED↔PROC direct path added	123.7	14	<0.001	0.98	0.98	0.97	0.07
10	FEED↔PROM direct path added	148.6	11	<0.001	0.98	0.98	0.98	0.04
11	PROC↔PROM direct path added	149.5	12	<0.001	0.96	0.97	0.96	0.06
12	MOT←COM direct path added	108.8	11	<0.001	0.97	0.97	0.97	0.05
13	MOT←INV direct path added	180.7	12	<0.001	0.98	0.98	0.98	0.06
14	MOT←FEED direct path added	114.9	13	<0.001	0.99	0.98	0.97	0.07
15	KNO←FEED direct path added	174.1	15	<0.001	0.98	0.96	0.99	0.06
16	MOT←PROC direct path added	189.3	17	<0.001	0.97	0.98	0.98	0.05
17	COMP←COM direct path added	190.6	15	<0.001	0.98	0.97	0.98	0.04
18	COMP←INV direct path added	114.8	13	<0.001	0.98	0.97	0.97	0.05
19	COMP←FEED direct path added	132.4	17	<0.001	0.98	0.98	0.98	0.06
20	PAR←FEED direct path added	117.5	13	<0.001	0.97	0.98	0.97	0.08
21	COMP←PROC direct path added	120.7	15	<0.001	0.98	0.98	0.97	0.07
22	COMP←PROM direct path added	113.8	19	<0.001	0.98	0.98	0.97	0.06

Note: χ^2: Chi-square, **d.f.:** degrees of freedom, **p**: probability level, **CFI**: Comparative Fit Index, **NFI**: Bentler–Bonnett Normed Fit Index, **TLI:** Tucker–Lewis Fit Index, **RMSEA**: root mean square error of approximation, **COM**: commitment, **FOR**: formation, **INV**: involvement, **FEED**: feedback, **PROC:** procedures, **PROM**: promotion policies, **KNO**: knowledge, **MOT**: motivation, **COMP**: compliance, **PAR**: participation.

The finalized model (Fig. 3) Reveals that the squared multiple correlations (R^2) for the endogenous variables in the model are safety commitment, safety training, safety communication and feedback, workers' involvement, safety rules and procedures and safety promotion policies.

The model shows direct relationships between the six antecedents' safety management of road safety practices. Hence, hypothesis H1 is partially supported. Similarly, safety commitment, safety training, safety communication and feedback, workers' involvement and safety procedures predict safety knowledge supporting hypothesis H2. In contrast, only the factor safety communication and feedback predicts safety motivation. Overall, hypothesis H2 receives only partial support. Hypothesis H4 also is supported because all the six antecedents' safety management of road safety practices predict safety performance components. There is significant direct path between safety commitment, safety training, safety communication and feedback, workers' involvement, safety procedures, safety promotion and safety compliance. Due to the absence of a direct significant path from safety commitment, safety training, workers' involvement, safety procedures and safety promotion to safety participation, we can conclude that the factor safety communication and feedback mediates the direct path between the six antecedents' safety management of road safety practices and safety participation. Hypothesis H5 receives only partial support.

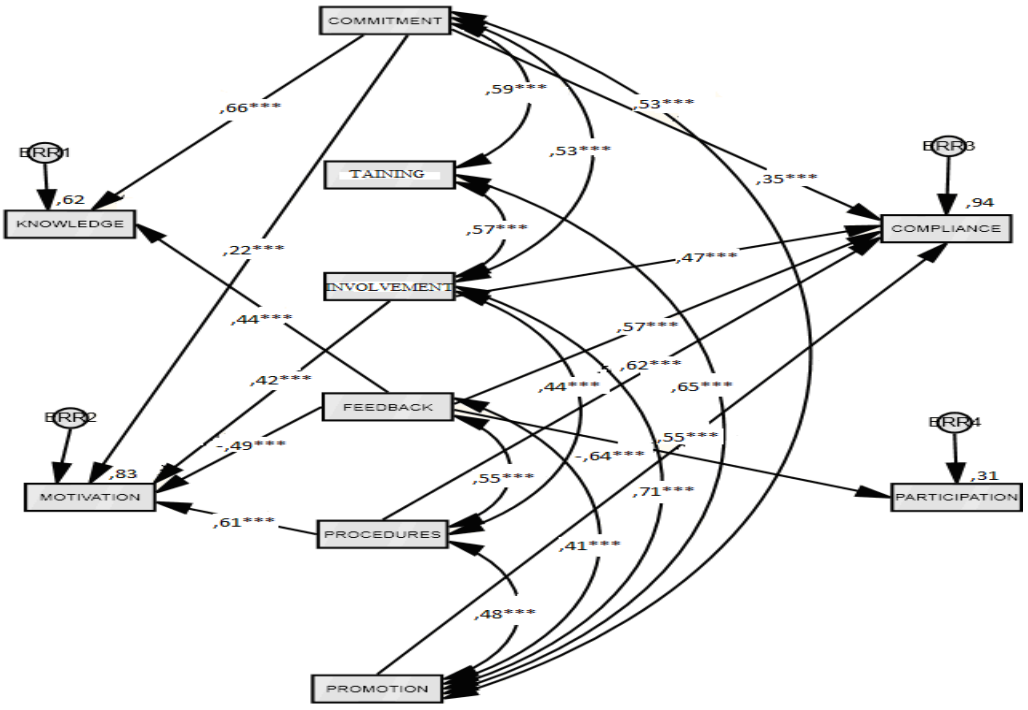

Figure (3): Final model with standardized path coefficients

DISCUSSION

The first purpose of this study was to establish the unidimensionality and reliability of the six antecedents' safety management of road safety practices, two determinants and two components of safety performance. These have been successfully demonstrated initially so that further analyses of the

data can be carried out. The results of path analysis provided partial support to the hypothesized model. It is evident from Fig. 3 that the path coefficients are significant and the overall model has an acceptable fit to the data. As there are very few studies relating to employee safety in societies, this study provides sound insight into safety management of road safety practices and safety performance. The present study investigated the relationship between six safety management of road safety practices and the direct influence of safety performance. The results suggest that some safety management of road safety practices can have effects on knowledge and motivation, and that both factors are important determinants of safety performance. This information can be used in the design of interventions with emphasis on the most influencing safety management of road safety practices to ensure that they target both mediators; namely safety knowledge and safety motivation, to produce best results. This research can also help in the development of measurement systems to evaluate the effectiveness of safety management in road safety practices. Incorporating assessments of safety knowledge, safety motivation, safety compliance and safety participation along with the safety management of road safety practices into the safety monitoring systems will provide a more comprehensive assessment in terms of the effectiveness of safety management of road safety practices and their operation as well.

The most important finding of this study is the role of safety communication and feedback in safety management of road safety practices. Safety communication and feedback are found to predict safety knowledge, safety motivation, safety compliance and safety participation.

CONCLUSIONS

The results of this study provide strong empirical support for the theoretical model that antecedents' safety management, determinants and components of safety performance are closely associated. The study demonstrated the validity and reliability of the six perceived safety management of road safety practices, two determinants and two components of safety performance. The predictive capacity of the six antecedents' safety management of road safety practices in safety knowledge, safety motivation, safety compliance and safety participation was demonstrated. The study also demonstrated that the perceptions of safety management of road safety practices influence safety performance through their direct effects on safety knowledge, safety motivation, safety compliance and safety participation. These findings provide valuable guidance for researchers and practitioners in identifying the mechanisms by which they can improve road safety in the workplace.

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