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Effect of Safety Culture, Safety Performance and Management System on the Food and Beverage Manufacturing Industries in Nigeria

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ABSTRACT

This paper examines the influence of safety culture and safety management system on the safety performance of food and beverage (F&B) manufacturing industries in Lagos state, Nigeria. A survey involving 178 questionnaires from safety managers from the F&B manufacturing industries was conducted. The statistical tool SmartPLS was used for analysis due to its ability and flexibility for examining complex models. The results indicated that the safety culture and safety management system were statistically positively related to safety performance. Besides showing the suitability of SmartPLS in statistical analysis, the results also indicated that the firms that intend to achieve their outlined goals regarding safety could greatly benefit from a positive safety management system and safety culture.

Keywords: Safety culture, Management systems, Food Beverages, Manufacturing, Nigeria.

I. INTRODUCTION

The success of any organisation largely depends its ability to ensure employees safety in the workplace [1]. This is essential because accidents in organisations resulting from poor safety could result in loss of human capitals, financial damages, and loss of the organisation's reputation [2]. As such, it has become necessary for organisations to evolve ways to stem the ugly tide of poor organisational, safety and thermal comfort in the workplace [1, 3]. Consequently, operational management literature has revealed that

there is a paucity of research on how an organisation's attention to safety could result in the desired performance [4]. Hence, the need for safety in Nigeria is exceptionally pressing as reports have revealed that billions of dollars are lost daily from reoccurring industrial accidents not including unreported deaths and injury in the manufacturing industry [5].

More specifically, the food and beverages industries (manufacturing sub-sectors) reported increased amounts incurred on employee compensation from 2012 to 2015 [5]. Similarly, reports from the Nigerian Institute of Safety Professionals revealed that ₦3.5 billion to ₦5 billion (₦=Nigerian Naira) was paid by F&B industries as employee compensation resulting from occupational accidents. According to Ajakaye et al. [6], the employees in the Nigerian F&B industry are the most prone to occupational accidents.

Therefore, the objective of this paper is to examine how an organisation's value for safety can result in a desirable outcome. More specifically, the concept of an organisation's safety culture (SC) and safety management system (SMS) are examined as drivers of safety performance (SP). The SC and SMS are typically termed the precursors of any organisation's performance in occupational safety literature. Likewise, researchers have noted that organisations with a well-developed safety management system experience fewer accidents [7,8] and thus higher SP [9].

A. Safety performance (SP)

At the organisational level, various views and definitions for SP have emerged, although the scope remains a challenge for safety assessment. In general, SP refers to the state of safety in an organisation. Sawacha et al., [10] defined SP as accident occurrence to a person that results in various degrees of injury. Several researchers have also employed accident statistics to examine the SP in an organisation [9].

Similarly, Chang and Yeh [11] avowed that safety performance is the number of fatal and injury accidents along with property damage (PD) that have occurred in a firm in any given year. Grabowski et al. [12] avowed that safety performance is an element that measures an organisations perception of safety in the work environment. These definitions of SP emphasise the need for organisations to prevent their workers from accidents and injuries [13].

As a result, there are numerous dimensions and measures for SP in the workplace. Based on the various definitions, these dimensions and measures have been employed as proxies for examining SP at the organisational level. Several works of literature have revealed that the most consistent measures of SP are injury and accident rates [14,15]. However, these measures of SP problematic due to their insufficient sensitivity and lack of attention to risk exposure [16]. Consequently, other researchers now advocate for the use of subjective procedures such as measuring the psychological perception of safety [17,18].

However, some researchers have employed other dimensions to study SP, for instance, at the organisational level [19,20]. Furthermore, studies in the literature have revealed that researchers have diverse opinions on the dimensions and measures of safety performance. However, Feng et al., [21] noted that by and large, no single rule of SP is superior to others since the choice depends on the purpose of evaluation of the available resources.

B. Safety Culture (SC)

The concept of safety culture (SC) has been readily adopted by researchers to improve organisational safety [22,23]. In theory, the basic concept of SC emerged from the realm of organisational culture (OC) [24], which is a requirement for organisational performance (OP) [14]. In the present study, the concept of SC is considered a precursor for SP, since it reflects how committed an organisation is towards

safety. In addition, the SC seeks to examine the influence on an employee's attitude towards engaging in unsafe acts [25], which is the primary cause of workplace accidents [26]. Typically, these dangerous acts can mar the SP of a firm [27].

Therefore, the objective of any organisation's SC is to create a norm whereby employees are mindful of the risks within their environment and persistently lookout for hazards [28]. However, there is one closely related term know as safety climate. The safety climate is the surface manifestation of the SC measured directly through the attitude and perceptions of employees [29]. Numerous authors have not differentiated these two concepts, although the terms are used interchangeably [30].

Similarly, several dimensions of SC have been adopted by other researchers in the literature. Cox and Cox [31] acknowledged five (5) dimensions of SC. These typically comprise the safety attitude, responsibility, and efficacy of management on safety, environmental safety, and personal exemption. Although Guldenmund [24] argues that management commitment to safety is a prime factor of safety culture, Cox and Cheyne [32] posited that management commitment, management actions concerning safety, and physical environment are also critical components of SC. Neal [33] suggested that the values of management, communication of safety, safety practices and involvement of employees with safety in place of work, as dimensions to assess SC. Fernandez-Muniz et al. [34] stated that managerial commitment and employee involvement are dimensions of SC.

In summary, various dimensions reportedly constitute the basis of safety culture. However, numerous idiosyncrasies and inconsistencies remain as to which indicators make up SC. Literature has revealed that the most consistent dimensions are management commitment and employee involvement [32,34-37]. Therefore, this study defines definite SC as a situation where managers show commitment, prioritise, and reinforce the rules and procedures for safety. Besides, it ensures employees adhere to and routinely partake in the improvement and establishment of safety regulations in the workplace [37]. Considering the above definitions, the present study views SC as one-dimensional since other studies on organisational SC have also regarded the concept in this regard [36,37].

C. Safety management system (SMS)

The safety management system (SMS) is a management tool adopted by an organization to handle safety [38]. The SMS comprises various policies, practices, roles, procedures and functions that are related to safety in the workplace [39]. Likewise, the SMS can be referred to as the organisational plans or mechanisms incorporated to curb hazards that affect the health and safety of workers [34,40]. As a result, the SMS is regularly employed to reduce the direct and indirect incidents costs, along with the economic effects of safety on organisations [41]. However, it should be noted that to achieve safety goals, an SMS alone is insufficient [42]. Hence, the organisational culture needs to support the SMS to enable it to achieve its desired goal of accident prevention.

II. HYPOTHESIS DEVELOPMENT

A. Safety culture and safety performance

Some empirical studies in occupational safety literature have revealed that a positive SC is essential for ensuring organisational safety outcomes [36,37]. The SC establishment helps to decrease injuries and accidents by providing higher levels of employees' safety compliance and safety behaviour [43]. Empirically, Mcfadden et al. [36] observed that hospital organisations experienced better safety outcomes when the organisation's safety culture was bolstered. In a similar study, Hajmohammad and Vachon [37] reported that Canadian firms recorded higher scores of SC where critical determinants of firm's safety performance were in place. Fernandez-

Muniz et al. [2] stated that firms with an SC whereby management is committed and involved in safety typically achieved positive performance.

H1: Safety culture is significantly and positively related to safety performance.

B. Safety management system and safety performance

Various studies have confirmed that SMS is an understated resource that offers organisations practical benefits [2,44]. The study by Fraizer et al. [44] reiterated that when SMS is engraved within a firm the effect is a resulting financial benefit stemming from less cost spent on accidents suffered by employees or other effects of disasters. Bottani et al., [45] observed that out of 116 organisations studied, organisations that adopted an SMS showed a better safety performance compared to organisations without one in place.

Fernandez-Muniz et al. [34] developed a scale for an SMS based on 455 Spanish manufacturing firms using questionnaires administered to safety personals. The study observed that the proposed SMS effectively predicted the safety performance based on the data was collected. In a related study, Fernandez-Muniz et al. [2] found out among 455 Spanish firms, the data from safety officers showed that a high score for an SMS. The results showed that the organisation's safety performance improved based on reduced material damage to equipment, absenteeism, and personal injuries.

H2: There is a significant positive relationship between the safety management system and safety performance.

III. METHODOLOGY

The data was collected from F&B industries located in Lagos State, Nigeria. There are about 600 F&B manufacturing industries located in fourteen (14) industrial zones in Lagos, Nigeria. At the time of conducting this study, approximately seven (7) out of the fourteen (14) industrial zones situated in Lagos were under construction. Therefore, only industries in the seven functional industrial estates were considered for the study. The target population of the study consists of 350 respondents. The sample size was determined using the method of Krejcie and Morgan [46], making up a sample size of 186. Furthermore, the study employed a random sampling technique for data distribution using self-administered questionnaires.

Before the data distribution, each firm was phoned and informed of the purpose of the call; the researcher subsequently asked to speak to the firm's safety manager. This approach was on the findings of Fernandez-Muniz et al. [34] and Hajmohammad and Vachon [37] completed at the organisational level. Furthermore, the safety managers were selected based on their expected insights into the practices and procedures performed by their respective firms. In confirmation with the stipulated data collection procedure, 178 questionnaires were distributed of which the respondents returned 75% or 126 valid questionnaires, whereas 8 were rejected due to various faults.

A. Survey questionnaires

A total of 40 items measured on the 5-point Likert-scale were used to collect data from the three primary constructs of this study using a survey instrument. However, a total of seven items were used to measure safety culture that was adapted from the safety climate survey by Sexton and Thomas [47]. Like the McFadden et al. [36] and Hajmohammad & Vachon [37] approach, this study incorporated only 7 out of the original 19 items measured at organisational level

SC. The selected items were most closely associated with the definition of SC as described earlier. Studies by Hajmohammed et al. [37] and McFadden et al. [36] reported the reliability of 0.89 and 0.91 which is within acceptable limits as suggested by Nunnally [48] and Hair et al. [49].

The operationalised assets of persons, policies, resources, procedures and policies act together in an organised manner to ease damage and losses caused in the process and workplace. The safety management system (SMS) was measured using 29 items adopted from Fernandez-Muniz et al. [34]. The SMS items covered a wide-scale or range including preventive planning, policy, training in safety, communication, emergency planning, internal control, and benchmarking techniques. All the dimensions reportedly contained composite reliability ranging from 0.87-0.96, which is recommended by Nunnally [48].

Lastly, the safety performance (SP) was measured using 4 items on the 5-point Likert scale ranging from 1 (extremely dissatisfied) to 5 (extremely satisfied) as adapted from Fernandez-Muniz et al. [34]. The level of safety performance was based on the respondent's perceptions of the organisation. A high level of safety performance in an organisation is believed to provide better and safer working conditions for workers. Studies like Fernandez-Muniz et al. [34] reported 0.746 reliability, which is within the acceptable limits as suggested by Nunnally [48].

B. Data analysis

This study used the partial least square feature of SmartPLS 2.0 software for data analysis. Before this, data were subjected to preliminary analysis using SPSS before the evaluations of measurement and structural models. The initial investigations included data screening, missing data detection, and treatment.

C. Measurement model estimation

After the preliminary analysis, the measurement model was determined using SmartPLS. Based on this, the reliability, convergent validity, and discriminant validity of the study constructs were tested using the Fornell and Larcker [50] criteria. Reliability examines how consistent a measuring instrument can be used to check all the theories it is proposed to measure [51]. The PLS uses the reliability of individual items that comprise the construct and composite reliability of the items as a group to judge item inconsistency compared to the Cronbach alpha. The reliability of each item was determined using the item loadings of the construct. The composite reliabilities, as prescribed by Werts et al., [52] and Gotz et al., [53] was utilised to measure the reliability of the study variables.

Given the proposal of Fornell and Larcker [50], a Composite Reliability (CR) of 0.70 or more prominent is considered acceptable. As such, items which did not load above the recommended threshold were deleted and the average variance extracted (AVE) of the construct was determined to assess the convergent validity. Typically, the AVE should exceed 0.5, which signifies that at least half of the variance items was shared with the construct. To test for discriminant validity, the constructs item must load more on its construct compared to others. The discriminant validity signifies the extent to which a construct is genuinely distinct from other constructs by empirical standards [51]. The constructs in this study include safety culture (SC), safety performance (SP), and safety management system (SMS). However, the safety management system is a second and third-order construct as such; its dimensions had to undergo second-order analysis. Table I shows the reliability and convergent validity of the measurement model.

TABLE I. RELIABILITY AND CONVERGENT VALIDITY

	Items	Loading	composite reliability	AVE
	SC1	0.841	0.904	0.703
Safety culture	SC2	0.814		
	SC3	0.864		
	SC7	0.833		
Policy	SMS1	0.861	0.841	0.640
	SMS2	0.761		
	SMS3	0.773		
Incentives	SMS5	0.822	0.891	0.732
	SMS6	0.834		
	SMS7	0.907		
	SMS8	0.852	0.888	0.666
Training	SMS9	0.855		
	SMS10	0.805		
	SMS12	0.748		
	SMS13	0.834	0.840	0.638
Communication	SMS14	0.825		
	SMS15	0.733		
	SMS16	0.767	0.809	0.585
P planning	SMS17	0.781		
	SMS18	0.747		
	SMS19	0.765	0.869	0.623
E response	SMS20	0.824		
	SMS21	0.787		
	SMS22	0.780		
	SMS25	0.895	0.895	0.809
Int. control	SMS26	0.904		
	SMS28	0.814	0.845	0.732
Benchmarking	SMS29	0.895		
	SP1	0.924	0.913	0.724
Safety performance	SP2	0.888		
	SP3	0.744		
	SP4	0.837		

TABLE II. ITEMS LOADINGS AND CROSS-LOADINGS

Items	S culture	Policy	Ince	Train	Comm	P plan	E resp	Int cont	Bench	S perf
SC1	**0.841**	0.669	0.713	0.619	0.597	0.513	0.609	0.586	0.597	0.685
SC2	**0.814**	0.665	0.583	0.649	0.561	0.459	0.570	0.579	0.643	0.631
SC3	**0.864**	0.639	0.660	0.607	0.601	0.530	0.604	0.602	0.633	0.664
SC7	**0.833**	0.589	0.666	0.639	0.643	0.535	0.562	0.546	0.609	0.638
SMS1	0.679	**0.861**	0.640	0.746	0.481	0.457	0.527	0.560	0.609	0.639
SMS2	0.560	**0.761**	0.492	0.481	0.414	0.303	0.299	0.466	0.411	0.504
SMS3	0.585	**0.773**	0.542	0.570	0.467	0.415	0.489	0.498	0.554	0.553

SMS5	0.608	0.543	**0.822**	0.625	0.689	0.551	0.615	0.605	0.623	0.644
SMS6	0.634	0.581	**0.834**	0.515	0.620	0.522	0.585	0.561	0.604	0.637
SMS7	0.760	0.677	**0.907**	0.706	0.710	0.524	0.630	0.639	0.690	0.719
SMS8	0.608	0.633	0.592	**0.852**	0.586	0.447	0.510	0.608	0.532	0.613
SMS9	0.602	0.612	0.579	**0.855**	0.510	0.479	0.472	0.561	0.460	0.542
SMS10	0.593	0.599	0.612	**0.805**	0.685	0.491	0.547	0.637	0.578	0.646
SMS12	0.643	0.644	0.575	**0.748**	0.487	0.429	0.484	0.484	0.461	0.629
SMS13	0.672	0.563	0.762	0.682	**0.834**	0.552	0.631	0.608	0.620	0.695
SMS14	0.513	0.300	0.573	0.447	**0.825**	0.572	0.581	0.546	0.681	0.643
SMS15	0.513	0.489	0.526	0.526	**0.733**	0.425	0.367	0.511	0.459	0.522
SMS16	0.471	0.374	0.470	0.519	0.529	**0.767**	0.518	0.451	0.431	0.497
SMS17	0.424	0.363	0.471	0.364	0.554	**0.781**	0.542	0.488	0.530	0.580
SMS18	0.501	0.406	0.486	0.420	0.406	**0.747**	0.506	0.481	0.444	0.514
SMS19	0.569	0.510	0.596	0.507	0.454	0.525	**0.765**	0.489	0.537	0.586
SMS20	0.562	0.431	0.563	0.473	0.578	0.510	**0.824**	0.526	0.576	0.642
SMS21	0.568	0.483	0.564	0.556	0.454	0.514	**0.787**	0.519	0.535	0.642
SMS22	0.512	0.349	0.532	0.421	0.623	0.604	**0.780**	0.508	0.677	0.639
SMS25	0.577	0.544	0.626	0.618	0.611	0.593	0.555	**0.895**	0.601	0.704
SMS26	0.663	0.604	0.641	0.650	0.645	0.522	0.608	**0.904**	0.650	0.678
SMS28	0.453	0.400	0.484	0.341	0.491	0.398	0.550	0.457	**0.814**	0.586
SMS29	0.776	0.704	0.766	0.689	0.746	0.626	0.699	0.707	**0.895**	0.768
SP1	0.771	0.662	0.683	0.710	0.717	0.647	0.753	0.698	0.696	**0.924**
SP2	0.670	0.592	0.747	0.691	0.745	0.677	0.688	0.688	0.710	**0.888**
SP3	0.548	0.545	0.534	0.471	0.525	0.473	0.584	0.572	0.708	**0.744**
SP4	0.653	0.621	0.676	0.640	0.658	0.544	0.672	0.648	0.626	**0.837**

TABLE III. DISCRIMINANT VALIDITY

S CULTURE	S PERF	bench	comm	E.resp	Incent	int cont	p plan	policy	train
0.839									
0.781	**0.851**								
0.740	0.801	**0.855**							
0.716	0.783	0.739	**0.799**						
0.700	0.795	0.738	0.670	**0.789**					
0.783	0.780	0.748	0.788	0.714	**0.855**				
0.804	0.745	0.755	0.764	0.740	0.771	**0.899**			
0.607	0.693	0.613	0.651	0.683	0.622	0.651	**0.765**		
0.764	0.712	0.666	0.569	0.560	0.704	0.703	0.497	**0.800**	
0.749	0.746	0.626	0.699	0.619	0.723	0.787	0.567	0.762	**0.816**

The figures in bold represent the square root of the average variance extracted while the other numbers represent the squared correlations.

D. Structural model assessment

After the reliability and convergent validity of the measurement model were achieved, the structural model was analysed. This analysis is typically performed to determine the relationship between the study variables.

E. Hypothesis Testing

Table IV shows presents the t-values. As observed, all hypotheses were significant at $p<0.1$.

TABLE IV. PATHS COEFFICIENTS

Relationships	Beta values	Std Error	t statistics	Decision
Safety culture -> S performance	0.191	0.007	2.755	Supported
Safety management system -> S performance	0.693	0.072	9.574	Supported

Hence, it is evident that the safety culture and safety management system have a direct positive relationship with safety performance. Therefore, the hypotheses are valid.

IV.DISCUSSION AND CONCLUSION

The significant result from the study suggests that when organisations care about employees' safety, the desired performance is achieved. The positive SC of an organisation is reflected in its management, care, and commitment to the employees' safety. This situation enhances the employees' active involvement in safety-related issues and decision making, which is considered a driver of safety performance. Hence, the results of this study are in tandem with Hajmohammad and Vachon [37] and McFadden et al. [36]. More so the results further confirm the findings of Kaynak [54] and Huselid et al. [55] who outlined the benefits of management commitment and employee empowerment in organisational performance in other management fields.

The second hypothesis of the study was also supported. As observed, firms with a well-developed safety management system, such as the case described in this study will have improved outcomes. A safety management system in an organisation benefits an organisation through better understanding, control and knowledge of organisational hazards [42]. Besides, it provides management with the means to shape up employee attitude in engaging in unsafe acts. Thus, the hypothesis agrees with Fernandez-Muniz et al. [19, 34] and Carrillo et al. [56]. More specifically, it highlights the importance of a safety management system in determining organisational performance in Nigerian firms, which supports the claims by Akpan [57]. This study has highlighted the role of safety culture and safety management system in determining organisations effectiveness. Over the years, it has become necessary that firms that seek organisational success should improve and implement their safety culture and safety management system in all ramifications.

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