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Original Article

The impact of safety culture dimensions on workplace accidents: an application in the Moroccan automotive industry

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ABSTRACT

Introduction: There is a general accord that safety culture is multidimensional, but there is limited research and publications about those dimensions. Almost one-third of the publications presenting safety culture definitions do not discuss the safety culture dimension nor the relationship between the safety culture dimensions and workplace accidents. To further understand the factors influencing this correlation, the following study was established to investigate the relationship between the safety culture dimensions and occupational accidents. This study aims to identify the safety culture dimensions in the automotive industry in Morocco and its relations with occupational accidents.

Methods: A study was done with 35 of the largest automotive companies in Morocco. The effects of safety culture on workplace accidents in the automotive industry were examined based on a literature review, and a measurement questionnaire was created with a sample of numerous automotive workers during 2 months in the winter semester of November and December 2022.

Results: The results show that safety culture dimensions have a strong influence on avoiding accidents, especially the common safety culture dimensions, which represent 40%. Based on the results gained from the Questionnaire the common safety culture dimensions are employees' attitudes/unsafe behaviors, lack of staff participation, and inadequate supervision. In addition, the COVID-19 period had a big impact on the number of occupational accidents in the automotive sector: 40.54% of these occupational accidents occurred between 2020 and 2022.

Keywords: Automotive, Dimensions analysis, Morocco, Occupational accidents, Safety Culture

Introduction

Safety culture is currently considered a proactive safety performance measurement and strategy for safety improvement; especially during uncertain situations such as COVID-19 and partial or full lockdowns. Keeping satisfactory levels of employee safety is a critical area of concern for many organizations and industries. In addition, the literature in both safety culture and safety climate research fields is growing at an exponential rate regardless of the historically delayed research activity.[1]

Stressful life situations such as pandemics, and wars, can have numerous negative implications for the mental health and psychological

functioning of an individual.[2] This can also impact employee performance in the workplace. Likewise, a recent study examines the influence of safety culture as a boundary condition for the relationship between work, COVID-19, and employee performance.[3] In addition, safety culture is a contentious notion. A recent study reviewed the qualitative interpretation of the safety culture.[4]

Moreover, safety culture is an important research domain in risk and safety science. Various industry and service sectors show significant interest in, and commitment to, applying its concepts, theories, and methods to enhance organizational safety performance.[4]

However, there is no acknowledged industry-wide definition and dimensions of the safety culture. In addition, there is also no clear difference between safety culture and safety climate. Gaps remain in the literature and there is no universal agreement about the definition or content of safety culture. Previous studies have a clear structure without consensus on the specific dimensions.[5]

The term "safety culture" first appeared in the International Nuclear Safety Advisory Group's report on the the 1986 Chernobyl disaster.[6] The safety culture in organizations has been defined differently in the literature and a collection of these definitions is provided by scholars.[6–8]

In addition, our interest is to achieve, in the Moroccan context, a better understanding of the safety culture determinants influencing occupational accidents in the automotive sector. The automotive industry appears as the most dynamic and most innovative in upstream logistics. It mobilizes a multiplicity of actors, all called to work in the long term, to create mutual benefits. The Moroccan automotive sector is expected to play a significant role in economic growth. The automotive sector's contribution to Morocco's GDP is expected to rise to 24 percent in 2023, meaning it will comprise nearly a quarter of the country's economic activity and income. Due to these developments, Morocco now ranks first in Africa in the automotive industry, surpassing Egypt and South Africa. [9]

In an attempt to address these gaps in the literature, the current study aims to provide an integrative review & identification of the safety culture dimensions contributing to occupational accidents in the automotive sector. To highlight the variables that explain the correlation, we will proceed as follows: in the first point, we will present the literature on the main safety culture dimensions. This will allow us to identify the variables and hypotheses used in our research purpose. A second point concerns the choice of the methodology and the interpretation of results. This work will conclude with a discussion of the implications and limitations of our study and future research.

The purpose of this study is to determine the main safety culture dimensions influencing occupational accidents in the Moroccan automotive sector. The analysis of our problem led us to focus on two areas of research:1) analysis of the safety incidents within the automotive industry in terms of their consequences and factors contributing to the incidents in Morocco, and 2) the nature of relationships between occupational accidents and the safety culture dimensions in the automotive sector in Morocco.

To answer these questions. we make the following assumptions:

H1: There is an impact of safety culture dimensions on occupational accidents.

H2: Employees' attitudes and behavior have a positive impact on occupational accidents

Methods

In this study, the effects of safety culture dimensions on workplace accidents in the automotive industry were examined, and a measurement questionnaire was used with a sample of numerous automotive workers.

Our research consists of 35 of the largest automotive companies in Morocco. Automotive managers were selected as the most relevant to complete the survey for this study. These

responsible managers can be regarded as the essential source of information on the results of the collaboration in which their company is engaged. The choice of the automotive industry is because this sector must now consider new constraints and challenges facing increasingly present (workplace safety conditions. competitiveness and well-being). So the choice of surveying managers in the automotive industry is not neutral. Indeed, in this sector, occupational accidents are considered a strategic issue.

Using SPSS 29 software, the 35 questionnaires were examined with a focus on workplace accidents in the Moroccan automotive industry and the influence of safety culture dimensions on accident occurrences. The hypotheses were tested using descriptive statistics.

The methodology adopted for this study is a systematic literature review of safety culture dimensions. The keywords were: "dimension, safety culture, drivers, components, factors, automotive". In addition. we used Google Scholar to identify additional cross-discipline literature. A total of 110 publications contributed to commentary, theory, or empirical research concerning the safety culture were selected. The searches were conducted in December 2022 by the first author. The selection process is detailed in Figure 1 below:

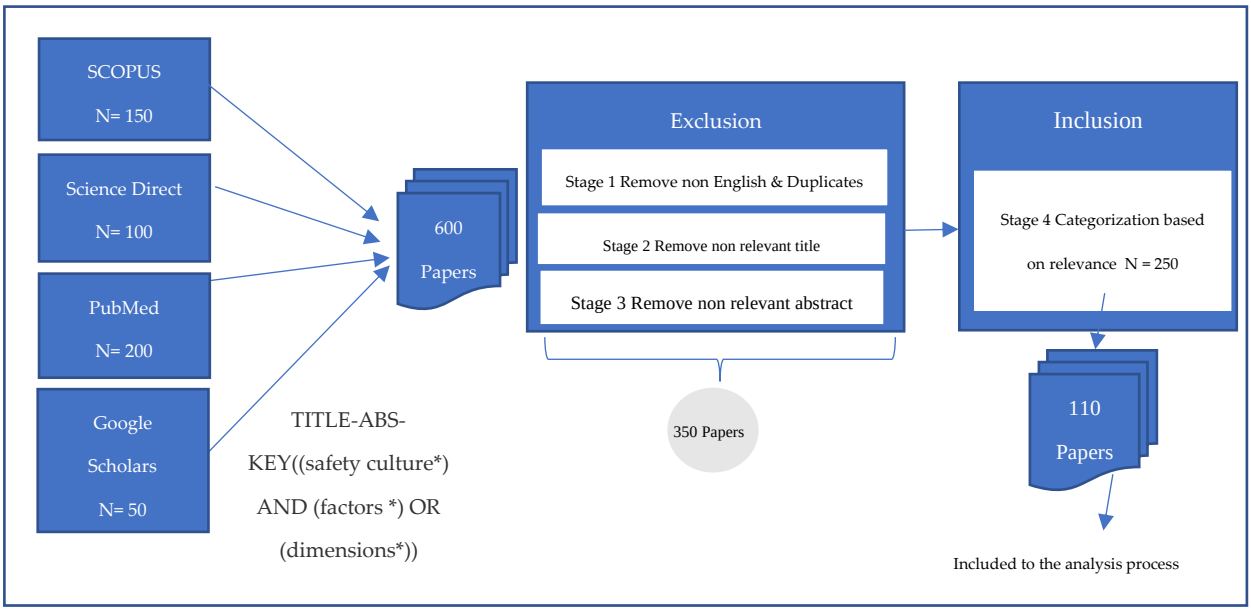

Figure 1: Overview of the selection process

A quantitative research design involving an online anonymous survey was used to elicit the perceptions of respondents on items that measure the relationship between incident and resilient safety culture dimensions in the automotive industry.

The introduction of the survey had the research purpose & objectives. The online survey was open for 2 months in the winter semester of November and December 2022. Relevant demographic data to assist in understanding the population was collected and highlighted in the descriptive data analysis of this paper.

To avoid collecting unnecessary data, potential risks and accidents that happened in the automobile sector were categorized into the 10 major accident types. Descriptive statistical techniques were used to look at the types of accidents, the work environment associated with accidents, the severity of injuries, and occupational groups.

Nineteen (19) variables in the questionnaire and 4 dimensions related to safety culture were identified; four variables each for the organizational dimensions, the individual dimensions, the environmental dimensions, and the psychological dimensions. Additionally, variables were chosen to examine the relationship

between accident incidence and safety culture aspects.

Participants were asked to rate each variable using the scales of "agree = 1" and "disagree = 0." The reliability coefficient for Cronbach's Alpha was calculated to be 0.8.

Table 1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.800	0.823	68

Results

Figure 2 & Figure 3 represent the size of the companies selected during our research. 45.7 % of the companies have upwards of 1000 employees and 42.86% of these companies have an age between 0-10 years of implementation.

Figure 4 represents the overall respondents & years of experience. Almost 74.3% of the respondents from Environment, Health & safety and 54.3% had almost 8 -12 years of experience and above which can be regarded as the essential source of information on the results of the collaboration in which they are engaged in the accident investigations and the root cause analysis determination.

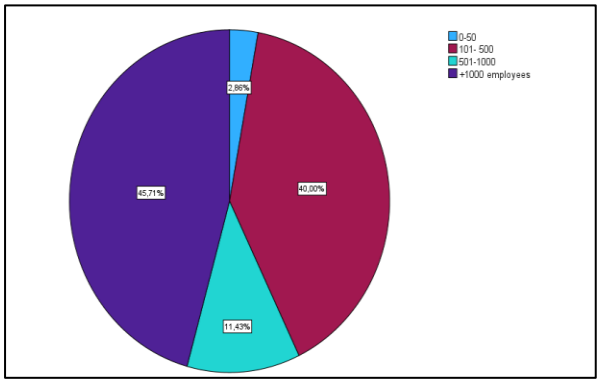

Figure 2: Size of the automotive companies

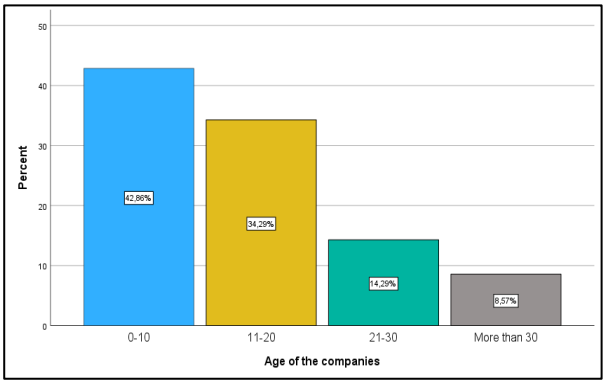

Figure 3: Age of the automotive companies

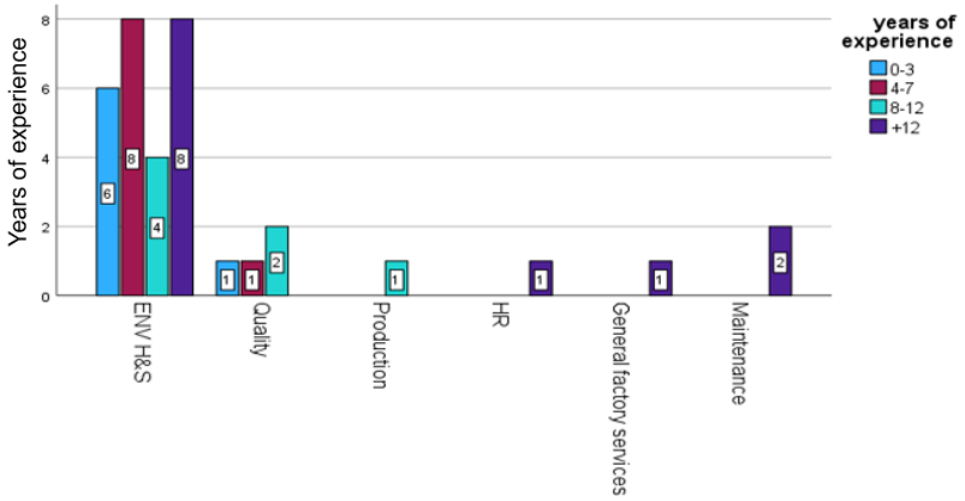

Figure 4: Department of respondents & year of experience in the automotive companies

In addition, Figure 5 represents the period of the large number of accidents in the automotive sector in Morocco. 40.54% of these occupational accidents occurred between 2020 and 2022.

The average number of automotive accidents were examined. Table 2 represents the repetition of the number of occupation accidents per year. 42.9% of automotive companies have between 0-2 accidents per year and 31.4% have between 3-5 accidents per year.

In this study, 10 accident categories, in particular, were shown to be more frequent in the Automotive industry which are listed in Table 3.

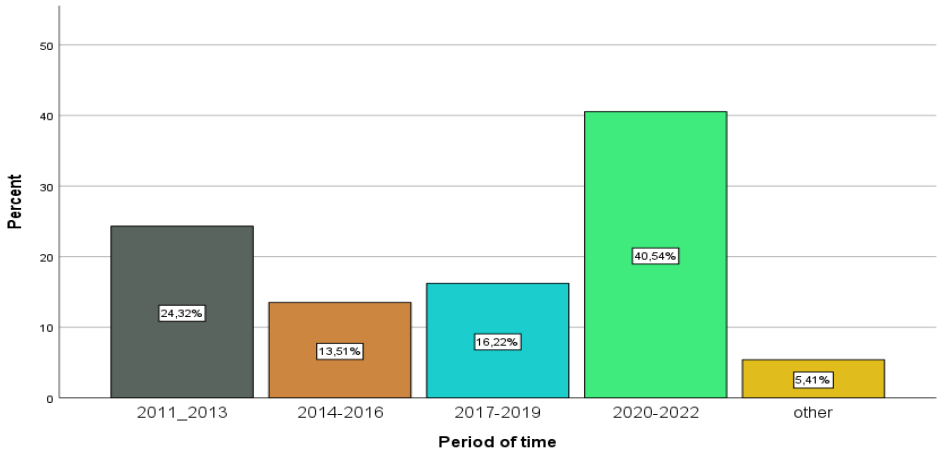

Figure 5: Period of the large number of occupational in the automotive companies

Table 2: number of occupational accident in the automotive companies

Accident per year	Percent
0-2	42.9
3-5	31.4
6-8	17.1
More than 9	8.6

Table 3: Type of occupational accident in the automotive companies

Type of accidents	Percent	Cumulative percent
Cut. stitched by	22.50	23
Hit by obstacle	17.50	40
Internal circulation	13.80	54
Slips trips & falls off from Height	12.50	66
Excessive effort. false movement	8.80	75
Falling objects	7.50	83
Stuck by	6.30	89
Frostbite or burn	6.30	95
Other	2.50	98
Fire. Explosion	1.30	99
Electricity	1.30	100

The analysis of the injuries in Table 4 has shown that the top five injuries represent almost 80% of occupational accidents: 32% of accidents overall resulted in cuts and wounds; 20% of total incidents resulted in body fractures, and sprains and low back pain accounted for nearly 22% of all injuries.

The study looked at the injury body locations. Table 5 shows that 6 body location categories were found to be more frequently occurring. 90 % of accidents were mainly on the hand & fingers (39.7%), foot (28.8%), head, face, neck (12.30%), and eye injuries with 11%.

The automotive industry plays a fundamental role in the Moroccan industry. In this study, we were looking at accidents. Almost 50% of the accidents occurred between the night shift (25.9%) and afternoon shift (23.5%), followed by the morning shift (19.8%) on the weekend (11%) and end of shift (11.1%) shown in Table 6.

Table 4: The severity of occupational accident in the automotive companies

Severity of accident	Percent
Cuts. wounds	31.9
Fracture	20.3
Sprain	10.1
Low back pain	10.1
Brun	8.7
Amputation	7.2
Eye Injury	7.2
Poisoning. asphyxiation	2.9
Other	1.4

Table 5: The body location of occupational accidents in the automotive companies

Body location of the accident	Percent
Hand. Finger	39.70
Foot	28.80
Head. face. neck	12.30
Eye	11.00
Shoulder. upper limb. wrist	6.80
Pelvis. lower limb. ankle	1.40

Table 6: The occupational accident moments in the automotive companies

Time of accident	Percent
Night shift 22H- 6H	25.9
Afternoon shift 14H - 22H	23.5
Morning shift 6H- 14H	19.8
Weekend	11.1
End of shift	11.1
Normal shift 8H- 18H	3.7
Overtime	3.7
Other	1.2

In addition, we studied the operations during the accidents in the automotive industry (Table 7). We see 57.1% occurred during routine operations & 42.9% during non-routine operations.

In Morocco, the automotive sector is crucial and has developed into a complex system. As a result, the research looked at occupations associated with accidents. Table 8 below shows the occupations where automotive industry accidents frequently happen.

Production operators represent almost 40% of injured occupations, followed by Maintenance technicians with 30.6% and warehouse operators with 20.8%.

Furthermore, in this study, we have examined the years of experience of the injured population in the Moroccan automotive industry. As shown below (Table 9), 70.3% of the injured persons have between 0-3 years' experience and 24.3% have between 4-7 years of experience.

Table 7: Type of occupational accident operations in the automotive companies

Accident operations	Percent
Routines operations	57.1
Non-Routines operations	42.9

Table 8: The type of occupational accident occupation in the automotive companies

Accident occupation	Frequency(N)	Percent
Production operator	29	40.3
Maintenance technician	22	30.6
Warehouse operator	15	20.8
Team leader	3	4.2
Contractor	2	2.8
Office Admin	1	1.4

Table 9: injured persons' seniority in the automotive companies

Years of experience	Percent
0-3 years	70.3
4-7 years	24.3
More than 7 Years	5.4

Safety culture dimensions' impact on accident incidence

The establishment of the H1 hypothesis was done to evaluate the effect of the safety culture dimensions on the occurrences of workplace accidents. Table 10 presents outcomes from the examination of the hypothesis H1.

The H1 hypothesis was accepted and the findings established that the primary five safety culture dimensions contributing to occupational accidents in Morocco's automotive industry are first, unsafe employee attitudes /unsafe behaviors.[10–12] Second, a lack of staff participation,[12–14] third, a lack of adequate supervision, [5,10,11,13,15] fourth, the risk perception and fifth, workload.[12]

Additionally, the H2 hypothesis was developed in order to investigate the influence of employee attitudes and behavior on the incidence of occupational accidents. Figure 6 displays the findings from the examination of the H1 hypothesis.

Table 10: Safety culture dimensions contributing to occupational accidents in the automotive companies

Safety culture dimensions	Percent	Cumulative percent
Attitudes or unsafe behaviors	21.1	21.1
participation or involvement of staff	11.9	33.0
Supervision	7.3	40.4
Risk perception	7.3	47.7
Workload	7.3	55.0
Staff competence	6.4	61.5
Safety value vs production	5.5	67.0
Communication	3.7	70.6
Incident reporting	3.7	74.3
OHS management system	3.7	78.0
Training or knowledge of staff	2.8	80.7
Staff awareness	2.8	83.5
Risk management	2.8	86.2
Work conditions	2.8	89.0
Maintenance preventive	2.8	91.7
Resources	2.8	94.5
Management commitment	1.8	96.3
Emergencies	1.8	98.2
Contractor management	1.8	100.0

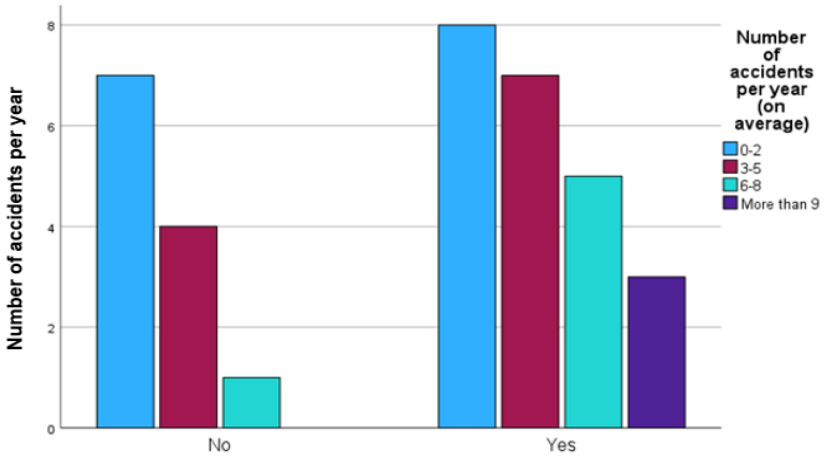

Figure 6: The impact unsafe attitudes or behaviors on the accident's occurrence

Discussion

The findings from this study were based on the evaluation of the safety culture dimensions in previous studies, which were considered and reviewed to establish a basis to understand the safety culture dimensions in the Moroccan Automotive sector in parallel with occupational accidents (Table 10) which is an important area of activity within safety science.[1]

Based on Figure 5, the period of a large number of accidents in the automotive sector in Morocco occurred between 2020 and 2022. In fact, stressful life situations such as pandemics and wars can have numerous negative implications on the mental health and psychological functioning of an individual.[2] This can also impact employee performance in the workplace. Likewise. a recent study examines the influence of safety culture as a

boundary condition for the relationship between work COVID-19 and employee performance.[3]

In fact, to meet the challenges during COVID-19, the safety of employees is of vital importance. Decreasing stress by maintaining a safety culture is necessary for improving employee safety performance.[3]

In addition, it might be observed in Table 8 that the majority of accidents have occurred around the 3 main categories of occupations & areas in the automotive industry: Production, Maintenance and warehouse areas. Almost 50% of the accidents occurred between the night shift and afternoon shift shown in Table 6. Moreover. Table 9 shows that 70.3% of the injured persons are between 0-3 years of experience.

In parallel. safety is impacted by a number of safety culture elements both at the organizational and individual levels.[10]

Several studies have been undertaken to examine safety incidents. A recent study found that safety culture is listed as the top six contributing factors to the US chemical manufacturing industry.[16]

Another study examined incidents across 14 industries. Their analysis of 81 incidents found the most common factors contributing to events were safety culture, emergency preparedness, and mechanical integrity.[17]

Table 10 summarizes the most common dimensions of safety culture. These are based on the review of 31 related papers, including Zhang. Murat Selçuk SOLMAZ and others.[10,15] In parallel. it presents safety culture dimensions contributing to occupational accidents in automotive companies.

According to the findings of this study: Moroccan auto workers' safety culture aspects had a significant impact on their ability to prevent accidents. Workers in the automotive sector are important contributors to a safe workplace. The results of this research on the impact of safety culture factors on occupational accidents have significant general implications. Table 9 demonstrates that accidents frequently include less-experienced individuals, which prompts us to emphasize the significance of safety training and supervision in the automotive industry as one of the causes of the increasing accident rate.

Conclusions

There are several factors affecting safety in the automotive sector in Morocco and safety culture is one of the most important. This study has revealed that safety culture dimensions in the automotive sector have a strong influence on employees in terms of avoiding accidents.

In addition, unsafe behaviors, employee involvement in safety, supervision, individual risk perception and workload are elements of the safety culture and the primary causes of accidents and incidents.

Recommendations: industries and regulators should adopt a safety culture conceptual framework & dimensions, develop guidance on safety culture self-assessment methodologies, conduct a review of how other companies can enhance their safety culture, develop a safety culture toolkit, and develop guidance on safety culture improvement strategies.

Future research on analyzing the possible relations between the study recommendations and proposing a model of a positive safety culture should be completed. In addition, increasing research should be conducted to develop ways and tools to assess an organization's elemental assumptions for capturing a much deeper knowledge of the safety culture.

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