

Research Article

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Human Factor in Occupational Safety Culture: The Holistic Effect of Education, Communication and Awareness

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ABSTRACT

Occupational health and safety (OHS) culture is strengthened by technical regulations and the human factor that shapes employee attitudes and behaviors. This study examines the holistic impact of safety communication, training, and employee awareness on safe behaviors. Data obtained from 450 employees across various sectors, based on a quantitative research design, revealed that safety communication creates an environment of trust beyond the mere transfer of information; safety training fosters behavioral change; and awareness plays a role in reducing accidents by increasing risk perception. The findings demonstrate that the human factor is a key determinant for the sustainability of an OSH culture.

This research demonstrates the critical role of the human factor in developing an occupational safety culture. By specifically examining the effects of safety communication, training, and awareness on safe behaviors, we aim to develop applicable policies and strategies within businesses. The study also aims to provide managers and practitioners with a systematic framework for strengthening an occupational safety culture.

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Introduction

The concept of occupational health and safety (OSH) is recognized not only as a legal obligation in modern industrial societies but also as one of the fundamental determinants of sustainable production and employee well-being. Rapidly increasing industrial activity, particularly since the second half of the 20th century, has revealed that occupational accidents and occupational diseases have serious economic, social, and psychological consequences on a global scale. Reports from the World Health Organization (WHO) and the International Labor Organization (ILO) indicate that millions of workers are removed from the workforce each year due to occupational accidents or diseases, creating significant costs for businesses and a significant burden on health and social security systems for society [1].

In this context, the concept of “occupational safety culture,” which encompasses physical protective measures and employee attitudes, behaviors, and awareness, comes to the fore. Safety culture can be defined as the sum of shared values, beliefs, norms, and behavioral patterns within an organization [2]. A developed safety culture enables employees to perceive risks better, adopt safe behaviors, and proactively prevent workplace accidents. Therefore, understanding the relationship between communication, training, awareness, and safe behavior in developing an occupational safety culture is critical from academic and practical perspectives.

One of the cornerstones of an occupational safety culture is safety

communication. Effective communication involves informing employees about potential hazards, clearly and understandably communicating the necessary precautions, and establishing mutual feedback mechanisms among employees. Safety communication is not merely a one-way transfer of information; it is also a two-way process where employees can share their experiences, report risks, and enable managers to evaluate this information and develop preventative measures. Research shows that lack of communication is one of the most significant causes of workplace accidents, and open communication channels play a decisive role in preventing accidents [3].

Another critical element in strengthening a safety culture is safety training. Training programs aim to enhance risk awareness and internalize safe behaviors, beyond simply increasing employees' technical knowledge and skills. Continuous, up-to-date, and practical training ensures the sustainability of a safety culture. Furthermore, due to the varying risks inherent in different departments, it is important to tailor training content to employees' roles and responsibilities. The literature emphasizes that employees who receive regular training are less likely to experience workplace accidents and have higher risk reporting behaviors [4].

Safety awareness refers to employees' sensitivity to workplace risks, their ability to recognize potential hazards, and their ability to take precautions. Employees with high awareness not only ensure their own safety but also the safety of their colleagues. This fosters the development of an occupational safety culture as a collective value. While safety awareness develops due to communication and training processes, it is also influenced by

individual experience, observation, and the organizational climate.

Finally, the concrete indicator of safety culture is safe behavior. Safe behavior is the outcome of the integration of training, communication, and awareness processes. Examples of safe behavior include employee actions such as using personal protective equipment (PPE), avoiding hazardous activities, adhering to procedures, and reporting risky situations. The literature emphasizes that safe behavior is the most effective strategy for preventing workplace accidents; however, it should not be viewed solely as an employee responsibility but rather be reinforced with organizational support [5].

For businesses, a strong safety culture not only contributes to reducing workplace accidents but also increases productivity, strengthens employee motivation, and protects corporate reputation. Furthermore, safety culture plays a critical role in mitigating legal and financial risks that may arise during the OSH compliance process. Studies conducted in European Union countries reveal that workplace accident rates are up to 40% lower in businesses with a strong safety culture [6]. This demonstrates that safety culture is a strategic element not only for individuals but also for corporate sustainability.

A significant portion of occupational accidents in Turkey and similar developing countries stem from factors such as lack of communication, inadequate training, low awareness, and a failure to promote safe behaviors. Therefore, examining the relationship between the components of safety culture will not only generate theoretical knowledge but also contribute to the development of practical policies and strategies. Studies, particularly in the service sector and industrial production, demonstrate that strengthening safety culture directly results in a reduction in accidents [7].

The primary objective of this study is to examine the relationship between safety communication, safety training, safety awareness, and safe behavior within the context of occupational safety culture using a quantitative research method. This study aims to fill the existing gap, particularly in the context, and contribute scientifically to the safety culture development processes of businesses. Furthermore, the findings will guide managers in designing more effective OSH policies, increasing employee participation, and establishing safety culture as an organizational value.

In summary, occupational safety culture should be considered not only an individual but also an organizational phenomenon. The relationship between safety communication, safety training, awareness, and behavior serves as mutually reinforcing elements in the development of safety culture. Therefore, the quantitative analysis conducted within this research aims to address this relationship within a holistic framework and contribute to both theoretical literature and practical applications.

Materials and Methods

Research Design

This cross-sectional study aims to analyze the relationships among safety communication, safety training, safety awareness, and safe behavior-components of occupational safety culture-using quantitative methods. The research was designed with an explanatory approach, adopting a hypothesis-driven approach to test causal relationships among variables.

Universe and Sample

The research population consisted of employees working in businesses operating in the service and manufacturing sectors in Turkey. Employees from various sectors (hotel management, food and beverage, construction, manufacturing, and logistics) were selected using a stratified sampling method, and valid data were collected from 450 participants. 42% of the participants were female, and 58% were male, with an age distribution ranging from 20 to 55.

Data Collection Tool

Data were collected using a survey based on scales commonly used in safety culture research. The survey consisted of three sections: Demographic information (age, gender, experience, sector, and educational background), Statements regarding safety communication, safety training, and awareness variables, Observable attitudes and behaviors related to safe behavior.

All statements were measured on a five-point Likert scale (1=Strongly Disagree, 5=Strongly Agree). Scale items were adapted from studies and back-translation was used in the adaptation to Turkish [3-5].

Validity and Reliability

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to test the scales' construct validity. EFA yielded a four-factor model, and CFA and fit indices ($\chi^2/df=2.31$, CFI=0.94, RMSEA=0.056) were found to be at acceptable levels. Reliability Cronbach's alpha coefficients ranged from 0.81 to 0.89.

Data Analysis

Collected data were analyzed using SPSS 26.0 and AMOS 24.0 software. Descriptive statistics were calculated, followed by Pearson correlation analysis to test the relationships between variables. Hypotheses were tested using multiple regression analysis and structural equation modeling (SEM) [8-10].

Findings and Discussion

Descriptive Findings

Sixty seven percent of participants have less than five years of work experience, and 52% work in the manufacturing sector. Regarding education level, 48% have a high school degree, 35% have a university degree, and 17% have a master's degree. Seventy-four percent of participants reported receiving at least one OSH training session, but only 41% reported attending training regularly.

Correlation Analysis

Correlation analysis showed a positive and strong relationship between safety communication and safety behavior ($r=0.62$, $p<0.001$). Similarly, significant relationships were found between safety training ($r=0.58$, $p<0.001$), safety awareness ($r=0.65$, $p<0.001$) and safe behavior.

Regression Findings

According to the results of multiple regression analysis, safety awareness has the strongest effect on safe behavior ($\beta=0.41$, $p<0.001$). This is followed by safety communication ($\beta=0.36$, $p<0.001$) and safety training ($\beta=0.29$, $p<0.01$). The total explanatory power of the model is 59% (Adj. $R^2=0.59$).

Structural Equation Model (SEM)

SEM analysis found that the effects of safety communication and safety training on safe behavior were partially indirect through

safety awareness. This supports the mediating role of awareness. The model's fit indices (CFI=0.93, TLI=0.91, RMSEA=0.061) were acceptable.

General Findings

Safety communication creates an atmosphere of trust among employees and increases compliance with procedures. Regular, practical safety training directly contributes to safe behavior by improving risk perception. Awareness plays a critical role in accident prevention by reinforcing the effectiveness of both communication and training processes. The human factor is the most decisive dimension of occupational safety culture [11-15].

Discussion

This study examined the decisive role of the human factor in shaping occupational safety culture using quantitative methods. It demonstrated the holistic effects of safety communication, training, and awareness on safe behaviors. The findings highlight three key points:

First, it was determined that safety communication transfers information and fosters an environment of trust within the organization. Open, two-way communication channels allow employees to report risks more easily and managers to develop preventative measures more quickly.

Secondly, regular and practical safety training has been shown to foster behavioral transformation in employees. Continuity, relevance of content to the task, and implementation of participant-focused methods play a critical role in the internalization of safe behaviors. Thirdly, safety awareness has been shown to be a mediating mechanism reinforcing the effects of communication and training processes. A high level of awareness strengthens risk perception and contributes to employees' proactive compliance with safety rules.

Overall, the research results demonstrate that the sustainability of an occupational safety culture depends on the effective management of the human factor, rather than technical measures. Safety communication, training, and awareness complement each other, supporting the development of safe behaviors, directly contributing to the prevention of workplace accidents. These findings demonstrate that organizations should develop their OSH strategies not only within the framework of regulatory compliance but also through holistic policies aimed at transforming employee attitudes and behaviors. Thus, occupational safety culture can be institutionalized as an individual responsibility and a corporate value and sustainability element.

The findings of this research indicate that strategies centered on the human factor should be developed to ensure the sustainability of an occupational safety culture. In this context, the following recommendations are offered: Businesses should embrace an OSH culture not only as a legal obligation but also as a corporate value. Management should support safety communication with a transparent and participatory model, ensuring active employee participation. Training should be designed as continuous, modular structures rather than one-time activities. Differentiated training content should be developed, considering job- and sector-specific risks. Practical training methods (simulations, case studies) should be preferred.

To raise safety awareness, businesses should implement visual warning systems, regular reminder campaigns, and behavior-focused programs. Reporting near-misses should be encouraged

and treated as learning opportunities.

Employee representatives should be encouraged to participate more actively in OHS committees. Rewarding employees who demonstrate safe behavior can increase motivation. This study used quantitative methods; future qualitative studies are recommended to examine employee perceptions and experiences more thoroughly. Comparative studies across sectors should be conducted to analyze the dynamics of safety culture in different sectors. Long-term longitudinal studies should test the permanence of the effects of training, communication, and awareness on safe behavior.

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