

## Modelling Value-Based Safety Culture Through Human Factors: Partial Least Squares Structural Equation Modelling Evidence from Indonesian State-Owned Enterprises



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### ABSTRACT

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This study examines how value-based human factors shape organizational safety culture in an Indonesian state-owned enterprise (SOE) operating in a high-risk industrial environment. Using survey data from 210 employees and partial least squares structural equation modelling (PLS-SEM), the study tests a model linking value-based human factors, safety-oriented work behavior, and organizational safety culture. Value-based human factors are operationalized through the AKHLAK core values of trustworthiness, competence, harmony, loyalty, adaptability, and collaboration. The results show that value-based human factors significantly predict safety-oriented work behavior ( $\beta = 0.47$ ,  $p < 0.001$ ) and organizational safety culture ( $\beta = 0.38$ ,  $p < 0.01$ ). Safety-oriented work behavior exerts the strongest direct effect on organizational safety culture ( $\beta = 0.52$ ,  $p < 0.001$ ) and partially mediates the relationship between value-based human factors and safety culture (indirect  $\beta = 0.24$ ). The model explains 56% of the variance in safety-oriented work behavior and 62% of the variance in organizational safety culture. These findings indicate that organizational values strengthen safety culture both directly and through their influence on everyday safety behavior. The study contributes to the safety culture and human factors literature by integrating a culturally grounded value framework into empirical safety modelling. It also provides practical implications for strengthening accountability, risk awareness, and behavioral compliance in high-risk public-sector organizations.

## 1. INTRODUCTION

Safety culture is widely regarded as a central factor influencing an organization's ability to manage operational risks and prevent accidents, particularly in complex industrial environments. While technical safeguards and formal procedures remain essential, safety performance increasingly depends on human and organizational elements such as values, attitudes, ethical judgment, and everyday work practices [1]. Research in high-risk sectors shows that failures rarely result solely from technological malfunction; instead, they frequently arise from interactions between technical systems and human behavior, including weak communication, insufficient accountability, and unsafe work practices [2]. Consequently, modern safety management frameworks emphasize the integration of human factors into organizational risk management systems.

Human factors research suggests that safety culture reflects collective patterns of beliefs and expectations that shape how employees interpret risk and respond to hazardous conditions. Organizations characterized by strong safety cultures tend to encourage proactive hazard identification, adherence to procedures, and shared responsibility for safety outcomes. In contrast, weak safety cultures are often associated with normalization of deviance, rule violations, and an increased

probability of accidents [3]. Within complex socio-technical systems where multiple actors and technologies interact, safety culture operates as an additional layer of control that influences both human reliability and system performance.

In high-risk organizations, particularly those operating at scale, formal safety rules alone are insufficient to ensure safe performance. Employees must internalize safety-related values that guide decision-making under uncertainty and operational pressure. Ethical commitment, professional competence, adaptability, and collaboration are increasingly viewed as essential human factors that enable effective risk management [4]. This perspective aligns with systems-based approaches to safety, which recognize that organizational values and behavioral norms shape how safety rules are interpreted and enacted in practice.

Recent research has increasingly examined the relationship between organizational culture, ethical leadership, and safety outcomes. Ethical climates characterized by trust, accountability, and integrity have been shown to positively influence safety compliance, reporting behavior, and risk awareness [5]. Professional competence and continuous learning are also associated with stronger hazard recognition and more effective error management. Collaboration and open communication are widely recognized as critical enablers of safe operations, particularly in environments where tasks are

interdependent and risks evolve rapidly [6]. Despite this growing body of research, ethical values, safety behavior, and safety culture are often treated as conceptually related yet analytically separate constructs.

Despite increasing recognition of the importance of ethics and organizational values in safety management, empirical models that explicitly integrate value-based human factors into safety culture analysis remain limited. This gap is particularly critical in high-risk state-owned enterprises (SOEs), where large-scale operations, complex organizational structures, and exposure to operational hazards require employees to make safety-critical decisions under uncertainty [7]. Understanding how institutionalized value frameworks translate into everyday safety behavior is therefore essential for strengthening risk management and ensuring consistent safety practices across large and complex public-sector organizations [8]. Empirical evidence is therefore required to clarify whether and how value-based frameworks function as effective human-factor drivers of safety culture.

In the Indonesian context, SOEs operate under a nationally defined set of core values designed to promote ethical conduct, professionalism, adaptability, and collaboration. These values provide a structured moral and behavioral framework intended to guide employee conduct across organizational levels [9]. However, their role in shaping safety-oriented behavior and organizational safety culture has not been examined sufficiently through rigorous analytical approaches. This issue is particularly significant given the scale, complexity, and risk exposure of SOEs operating in sectors such as agriculture, energy, transportation, and infrastructure.

From a human factors perspective, values influence safety outcomes indirectly by shaping individual behavior and collective norms. Employees who internalize ethical and professional values are more likely to engage in safety-oriented behaviors, including compliance with procedures, risk communication, and intervention in unsafe situations [10]. Over time, these behaviors contribute to the development and strengthening of a positive safety culture. Examining this mediating process is essential for advancing both theory and practice in safety management, as it clarifies how abstract values are translated into observable safety outcomes.

To address this research gap, this study develops and empirically tests a human factors model of value-based safety culture. Using the study's quantitative design and partial least squares structural equation modelling (PLS-SEM), the study analyzes the relationship between value-based human factors, safety-oriented work behavior, and organizational safety culture [11]. PLS-SEM is particularly suitable for this purpose because it enables the analysis of complex causal relationships among latent constructs and supports prediction-oriented modelling in organizational research.

The study is guided by three hypotheses. First, value-based human factors are hypothesized to have a significant positive effect on organizational safety culture (H1). Second, value-based human factors are expected to positively influence safety-oriented work behavior (H2). Third, safety-oriented work behavior is hypothesized to mediate the relationship between value-based human factors and organizational safety culture (H3). Together, these hypotheses represent a behavioral pathway through which values influence safety outcomes.

By empirically testing this model, the study contributes to the human factors and safety culture literature in several ways. Theoretically, it advances understanding of safety culture by

positioning values as upstream human-factor drivers rather than contextual background variables. Methodologically, it demonstrates the application of PLS-SEM to model the relationships among values, behavior, and culture in a safety context. Practically, the findings provide insights for safety management strategies that integrate ethical and behavioral considerations into organizational risk management systems.

In summary, this study argues that organizational safety culture cannot be fully understood without accounting for the role of value-based human factors and their influence on safety-oriented behavior. By modelling these relationships empirically, the research provides evidence that ethical and professional values constitute a critical foundation for sustainable safety culture in complex, high-risk organizations.

## **2. LITERATURE REVIEW**

### **2.1 Safety culture as a risk management capability**

Safety culture can be understood as an organizational capability that influences how risks are interpreted, communicated, and managed during routine operations [12]. Rather than existing solely as a set of formal policies, safety culture represents a shared system of meanings that shapes employees' perceptions of hazards, priorities, and acceptable trade-offs. These shared understandings affect whether workers follow procedures, raise concerns about unsafe situations, and learn from near-miss incidents [13].

The influence of safety culture becomes particularly significant in complex operational settings where tasks are interconnected, and working conditions may change rapidly. In such contexts, it is not possible for written procedures to anticipate every possible risk scenario. Consequently, organizations with similar technical systems may experience very different safety outcomes depending on how safety values are interpreted and enacted by employees in everyday practice [14].

### **2.2 Debates on the measurement of safety culture**

Scholars have raised methodological concerns regarding the measurement of safety culture, particularly when relying solely on questionnaire-based approaches. Survey instruments typically capture employees' perceptions of safety priorities rather than direct observations of operational practices or system reliability. For this reason, many researchers recommend interpreting survey findings alongside behavioral indicators such as incident reporting, safety participation, and learning processes following operational failures [15].

In large organizations, safety culture is shaped by multiple interacting subsystems, including leadership practices, communication patterns, and operational routines. As a result, no single measurement approach can fully capture its complexity. Therefore, integrating perceptual data with behavioral and organizational indicators provides a more comprehensive understanding of how safety culture develops and influences safety performance.

### **2.3 Human factors and safety-oriented work behavior**

Human factors theory provides an important conceptual basis for understanding the behavioral foundations of safety performance. From this perspective, safety outcomes are

influenced by cognitive, behavioral, and social processes such as competence, decision-making, teamwork, communication, and individual responsibility [16]. Contemporary safety research emphasizes that accidents rarely arise from isolated human mistakes. Instead, incidents typically occur through interactions between human actions and underlying organizational conditions embedded within complex systems.

Safety-oriented work behavior represents a key human-factor mechanism through which organizational conditions influence safety culture and performance. These behaviors include compliance with safety procedures, participation in safety activities, proactive communication of safety risks, and supporting colleagues in maintaining safe work practices [17]. These behaviors serve as observable manifestations of underlying values and norms and, when consistently enacted, contribute to the development of a shared safety culture.

Empirical studies indicate that organizations promoting open communication, psychological safety, and learning from mistakes exhibit higher levels of safety-oriented behavior. Conversely, environments characterized by blame, excessive production pressure, or weak leadership commitment often discourage reporting and risk awareness [18]. This evidence highlights that human behavior is not solely a function of individual disposition but is shaped by organizational signals regarding what is expected, rewarded, or tolerated.

Importantly, safety-oriented work behavior also functions as a mediating mechanism. Upstream organizational factors such as leadership, ethical climate, and value systems do not influence safety outcomes directly; rather, they shape the behaviors through which safety culture is enacted [19]. This insight has led to increased use of mediation models in safety research, positioning safety behavior as a proximal driver linking organizational antecedents to safety culture or safety performance.

## 2.4 Ethical values and value-based human factors

Ethical and value-based considerations have gained prominence in safety research as scholars seek to explain why employees act safely even in the absence of supervision or when facing conflicting goals [20]. Ethical values influence judgment, responsibility, and willingness to prioritize safety over short-term efficiency, functioning as internalized behavioral controls under uncertainty.

Value-based human factors extend traditional human factors perspectives by incorporating moral and ethical dimensions into safety analysis. Values such as integrity, responsibility, professionalism, adaptability, and cooperation shape how individuals interpret safety rules and respond to ambiguous or novel situations [21]. Research on ethical climate and moral identity indicates that strong ethical orientations are associated with lower rule violations, higher accountability, and greater engagement in safety-related activities.

Value-based approaches are particularly relevant in complex organizations where employees must exercise discretion and judgment. In such contexts, formal procedures cannot fully prescribe appropriate action, and ethical values provide guidance for decision-making. Values also influence interpersonal dynamics, including trust and collaboration, which are essential for effective communication and collective risk management [22]. Accordingly, ethical frameworks are increasingly conceptualized as “soft controls” that complement formal safety systems by reinforcing behavioral

consistency and moral responsibility.

Despite growing recognition of their importance, empirical studies often treat ethical constructs as background variables rather than integrating them explicitly into safety culture models [23]. This limitation reduces understanding of how values translate into concrete safety outcomes and through which behavioral mechanisms their effects occur.

## 2.5 Value-based safety culture and behavioral mediation

The relationship among values, behavior, and safety culture can be conceptualized as a multilevel process. Values represent relatively stable orientations influencing attitudes and judgments, which shape daily work behaviors such as compliance, communication, and risk awareness [24]. Over time, the aggregation of these behaviors forms shared norms and practices recognized as safety culture.

Mediation models are particularly well-suited for examining value-based safety culture. In such models, values are positioned as antecedents, safety-oriented work behavior as a mediator, and safety culture as the outcome [25]. This structure aligns with human factors theory, which emphasizes that organizational influences operate through behavior rather than directly determining outcomes.

Empirical evidence supports this logic. Ethical leadership and value-driven climates are associated with increased safety participation and compliance, which in turn contribute to stronger safety culture perceptions. However, most existing studies examine values in a generic sense and rarely account for culturally specific value systems that may shape safety behavior in different organizational contexts.

## 2.6 AKHLAK core values as a value-based human factor framework

In Indonesian SOEs, the AKHLAK values Amanah, Kompeten, Harmonis, Loyal, Adaptif, and Kolaboratif provide an official behavioral standard intended to guide conduct across organizational roles and operational units. In safety-critical settings, these values can be interpreted as human-factor mechanisms that influence compliance, communication, learning, and coordination. However, empirical evidence regarding the role of AKHLAK values in shaping safety-oriented behavior and organizational safety culture remains limited, particularly in high-risk operational environments.

## 2.7 Conceptual mapping of AKHLAK values to human factors constructs

To strengthen the theoretical foundation of AKHLAK as a value-based human factors framework, each value dimension can be conceptually linked to established safety-related human factors constructs. Trustworthiness (Amanah) reflects accountability and ethical responsibility, which are closely associated with safety compliance and adherence to procedural standards. In safety-critical environments, trustworthiness reduces intentional rule violations and promotes transparent reporting of hazards and near-miss incidents.

Competence (Kompeten) corresponds to professional capability and technical expertise, which are central elements of human performance reliability. Competent employees possess the knowledge and skills required for hazard recognition, safe task execution, and effective response to

unexpected operational conditions.

Harmony (Harmonis) relates to interpersonal respect and psychological safety within teams. In safety research, psychological safety has been shown to encourage open communication and the willingness to report safety concerns without fear of blame, thereby supporting collective risk awareness.

Loyalty (Loyal) reflects commitment to organizational goals and long-term responsibility for organizational outcomes. Within safety contexts, such commitment supports consistent adherence to safety policies and reinforces shared responsibility for maintaining safe operations.

Adaptability (Adaptif) corresponds to situational awareness and adaptive decision-making. In dynamic and uncertain environments, workers must continuously interpret changing conditions and adjust their behavior to maintain safe system performance.

Collaboration (Kolaboratif) corresponds closely to teamwork and team communication, which are widely recognized as critical determinants of safe performance in complex systems. Effective collaboration enables coordination across roles, supports information sharing, and facilitates collective problem-solving in safety-critical situations.

By mapping the AKHLAK dimensions onto established human factors constructs, the framework can be more clearly understood as an integrated value-based system that shapes safety behavior and contributes to the development of organizational safety culture.

## 2.8 Conceptual implications for empirical modelling

Integrating AKHLAK into a human factors-based safety culture model offers both theoretical and practical value. Theoretically, it extends safety culture research by embedding a culturally grounded value framework within established human factors mechanisms. Practically, it provides a basis for safety interventions that move beyond procedural compliance to address ethical and behavioral foundations of safe work.

PLS-SEM is well-suited for testing such models because it allows simultaneous assessment of measurement and structural relationships among latent constructs and supports prediction-oriented analysis [26]. By applying PLS-SEM, the present study empirically examines how value-based human factors influence organizational safety culture through safety-oriented work behavior.

In short, the literature indicates that the culture of safety adapts to human factors that function through behavioral mechanisms and that ethical values function as critical upstream drivers of these mechanisms. The AKHLAK core values provide a structured and contextually relevant framework for examining value-based safety culture in Indonesian SOEs. Empirical modelling of these relationships can advance understanding of how values, behavior, and culture interact to support effective risk management in complex organizational systems.

## 3. METHODS

### 3.1 Research design

This research uses a quantitative explanatory design to analyze the relationships between value-based human factors,

safety-oriented work behavior, and organizational safety culture. The explanatory approach is intended to evaluate theoretically derived relationships between constructs and to identify causal mechanisms linking organizational values with safety outcomes. A survey methodology was selected because it allows the systematic collection of data from a large number of workers and enables the coherent measurement of organizational perceptions, attitudes, and behavioral tendencies.

PLS-SEM was employed as the primary analytical technique because the study aims to explain and predict the key target construct, organizational safety culture, within a structural model that includes both direct and mediated relationships. Specifically, the research examines how value-based human factors influence safety culture both directly and indirectly through safety-oriented work behavior. This prediction-oriented objective aligns with the strengths of PLS-SEM, which is widely recommended for estimating complex causal models focused on explaining variance in key outcome constructs. This approach allows the measurement and structural models to be evaluated simultaneously and allows latent constructs, such as values, safety behavior, and safety culture, to be evaluated within a single analytical framework.

### 3.2 Population and sample

The study was conducted within an Indonesian SOE operating in a high-risk industrial environment. The organization was selected because it has formally adopted the AKHLAK core values as a standardized ethical and behavioral framework and operates under conditions involving occupational hazards and complex operational processes. This context provides a relevant setting for examining the role of value-based human factors in shaping safety-oriented behavior and safety culture.

The target population consisted of permanent employees across operational and administrative functions. A sampling strategy was applied to ensure that respondents had sufficient exposure to security practices and organizational values. Employees involved in daily operations, supervision, and safety-related decision-making were considered particularly relevant to the study objectives.

The adequacy of the sample size was evaluated based on model complexity and statistical power considerations following recent PLS-SEM guidelines. The proposed structural model includes two endogenous constructs and multiple structural paths, requiring sufficient observations to detect meaningful relationships among latent variables. The final sample of 210 respondents exceeds the recommended thresholds for PLS-SEM applications and provides adequate statistical power to detect moderate effect sizes in structural relationships. Post-hoc analysis indicated that the sample size was sufficient to reliably estimate the reported path coefficients.

### 3.3 Data collection

Data were collected using a structured questionnaire designed to measure value-based human factors, safety-oriented work behavior, and organizational safety culture. The instrument was developed by adapting items from established measurement scales and aligning them with the organizational and cultural context of Indonesian SOEs. All items were phrased in clear and accessible language to ensure

comprehension across different educational and occupational backgrounds. A detailed overview of all constructs, measurement items, and their original sources is provided in Table 1, allowing full transparency and replicability of the measurement design.

**Table 1.** Measurement constructs and example items

Construct	Example Items	Source
Value-based human factors (AKHLAK)	I fulfill my work responsibilities with integrity (Amanah). / I continuously improve my professional skills (Kompeten). / I cooperate effectively with colleagues (Kolaboratif).	Adapted from AKHLAK framework and organizational values studies
Safety-oriented work behavior	I follow established safety procedures during my work tasks. / I report unsafe conditions when they occur.	Adapted from safety behavior literature
Organizational safety culture	Management in this organization prioritizes safety. / Employees openly discuss safety concerns.	Adapted from safety culture research

Note: AKHLAK = Amanah, Kompeten, Harmonis, Loyal, Adaptif, and Kolaboratif.

The questionnaire consisted of three sections. The first measured value-based human factors, operationalized through indicators reflecting the six AKHLAK core values: trustworthiness, competence, harmony, loyalty, adaptability, and collaboration. The second measured safety-oriented work behavior, including adherence to safety procedures, participation in safety activities, risk communication, and proactive safety initiatives. The third assessed organizational safety culture, focusing on shared safety norms, leadership commitment, and openness in safety communication.

All items were measured using a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Before full-scale data collection, a pilot test was conducted with a small group of workers to assess the clarity, reliability, and relevance of the instrument. Feedback from the pilot test was used to refine item wording and improve instrument accuracy.

Ethical considerations were taken into account throughout the data collection process. Participation was voluntary, respondents were informed of the purpose of the study and of their right to withdraw at any time, and anonymity and confidentiality were assured. Informed consent was obtained from all participants before data collection began.

### 3.4 Measurement model

The measurement model was evaluated following established PLS-SEM procedures. Internal consistency reliability was assessed using Cronbach’s alpha and composite reliability (CR). Convergent validity was examined through the average variance extracted (AVE) and standardized indicator loadings. Discriminant validity was evaluated using the Fornell–Larcker criterion and the heterotrait-monotrait ratio (HTMT) to confirm that the constructs were empirically distinct.

### 3.5 Structural model

After establishing the adequacy of the measurement model, the structural model was evaluated to examine hypothetical

relationships between latent constructs. Path coefficients were estimated and tested using a non-parametric bootstrapping method with 5,000 samples to obtain standard errors, t-statistics, and confidence intervals.

Model explanatory power was assessed using the coefficient of determination ( $R^2$ ) for the endogenous constructs. Following commonly used guidelines,  $R^2$  values of 0.25, 0.50, and 0.75 were interpreted as weak, moderate, and substantial explanatory power, respectively. Predictive relevance was evaluated using the Stone–Geisser  $Q^2$  statistic, where values greater than zero indicate predictive capability.

Mediation was tested by examining the significance of indirect effects through bootstrapping and determining whether the mediation was partial or complete based on the significance of both direct and indirect pathways. Since the data were collected using a single questionnaire at one point in time, possible common method bias was addressed through procedural remedies such as anonymity assurance, separation of questionnaire sections, and neutral item wording. In addition, collinearity diagnostics were assessed using the Variance Inflation Factor (VIF); all VIF values were below the recommended threshold, suggesting that common method bias was unlikely to materially affect the structural estimates.

### 3.6 Software and statistical criteria

All analyses were conducted using SmartPLS version 4.0, which supports comprehensive PLS-SEM measurement and structural model evaluation. Descriptive statistics and preliminary data screening were performed using standard statistical software prior to SEM analysis.

A significance level of 0.05 was adopted for all hypothesis tests. Multicollinearity among predictor constructs was assessed using the VIF, with values below 5 indicating that multicollinearity was not a concern and that parameter estimates were stable and interpretable.

The combination of robust estimation procedures, established validity and reliability criteria, and transparent reporting ensures the methodological rigor and replicability of the study.

## 4. RESULTS

This section reports the PLS-SEM findings, including the measurement model assessment, structural model evaluation, hypothesis testing, and mediation analysis. Results are presented with supporting tables and the structural model figure.

As all variables were collected through a single survey instrument, common method bias was statistically assessed using Harman’s single-factor test. An exploratory factor analysis including all measurement items was conducted. The results indicated that the first factor accounted for less than 50% of the total variance, suggesting that common method bias was not a serious threat to the validity of the results. This finding provides additional support for the robustness of the measurement model and subsequent structural analysis.

### 4.1 Measurement model results

The measurement model was evaluated before the analysis of the structural relationships to ensure that all latent constructs met the established reliability and validity criteria.

The evaluation followed established PLS-SEM standards and included internal consistency reliability, convergent validity, and discriminant validity.

Internal consistency reliability was assessed using Cronbach's alpha and CR. As reported in Table 2, Cronbach's alpha values ranged from 0.91 to 0.93, while CR values ranged from 0.94 to 0.95. All values exceeded the recommended threshold of 0.70, indicating strong internal consistency across indicators within each construct. These results demonstrate that the measurement items consistently capture the desired latent variables.

Convergent validity was evaluated using the AVE. The

AVE values for value-based human factors (0.71), safety-oriented work behavior (0.70), and organizational safety culture (0.72) all exceed the minimum recommended value of 0.50. This indicates that each construct explains more than half of the variance in its indicators, confirming adequate convergent validity. Indicator reliability was evaluated by examining the standardized outer loadings. All indicators loaded above 0.70 on their respective constructs, confirming that the observed variables are adequate and reliable representations of the underlying latent constructs. The standardized outer loadings ranged between 0.72 and 0.89, further confirming adequate indicator reliability (see Table 2).

**Table 2.** Measurement model reliability and convergent validity

Construct	Cronbach's $\alpha$	Composite Reliability (CR)	Average Variance Extracted (AVE)	Outer Loadings (Min–Max)
Value-based human factors (AKHLAK)	0.93	0.95	0.71	0.72 – 0.88
Safety-oriented work behavior	0.92	0.94	0.70	0.74 – 0.87
Organizational safety culture	0.91	0.94	0.72	0.76 – 0.89

Note: All standardized outer loadings exceeded the recommended threshold of 0.70. No measurement items were removed during the measurement model evaluation

Discriminant validity was assessed using both the Fornell–Larcker criterion and the HTMT. The Fornell–Larcker assessment showed that the square roots of each construct's AVE were greater than its correlations with other constructs, confirming that each construct shares more variance with its own indicators than with other constructs. In addition, all HTMT values were below the conservative threshold of 0.85, providing further evidence of discriminant validity. These results confirm that the constructs are empirically distinct and free from problematic overlap.

Overall, the measurement model shows adequate reliability and validity, providing a solid basis for evaluating structural models and performing hypothesis testing.

**Table 3.** Structural model path coefficients

Structural Path	Path Coefficient ( $\beta$ )	T-Value	P-Value
Value-based human factors → Safety-oriented work behavior	0.47	8.11	< 0.001
Value-based human factors → Organizational safety culture	0.38	6.94	< 0.01
Safety-oriented work behavior → Organizational safety culture	0.52	9.08	< 0.001

## 4.2 Structural model results

After establishing the adequacy of the measurement model, the structural model was evaluated to examine the hypothesized relationships among value-based human factors, safety-oriented work behavior, and organizational safety culture. Path coefficients were estimated using a bootstrapping procedure with 5,000 resamples to obtain robust standard errors, t-values, and significance levels.

The results of the structural model analysis are presented in Table 3. All hypotheses were supported and statistically significant.

Value-based human factors have a strong positive effect on safety-oriented work behavior ( $\beta = 0.47$ ). Employees who

internalize ethical and professional values are more likely to engage in workplace behaviors that support safety. These behaviors include compliance with safety procedures, proactive communication of hazards, participation in safety programs, and peer support for safe practices.

Value-based human factors also exert a significant direct effect on organizational safety culture ( $\beta = 0.38$ ). This result indicates that ethical and cultural values influence shared safety perceptions, leadership commitment to safety, and collective responsibility, independent of their effect through individual behavior. In this sense, values function as foundational elements shaping the ethical climate and shared meaning surrounding safety.

Safety-oriented work behavior demonstrates the strongest effect on organizational safety culture ( $\beta = 0.52$ ). This result highlights the central role of daily safety-related behavior in shaping and reinforcing safety culture. When employees consistently enact safety-oriented behaviors, these actions accumulate over time and become institutionalized as shared norms and expectations regarding safe work practices.

The explanatory power of the model was assessed using the coefficient of determination ( $R^2$ ). The results are presented in Table 4.

**Table 4.** Coefficient of determination ( $R^2$ )

Endogenous Construct	$R^2$
Safety-oriented work behavior	0.56
Organizational safety culture	0.62

Value-based human factors explain 56% of the variance in safety-oriented work behavior, indicating substantial explanatory power. In addition, value-based human factors and safety-oriented work behavior jointly explain 62% of the variance in organizational safety culture. These values indicate substantial explanatory power in organizational and behavioral research, highlighting that the proposed model includes essential determinants of safety culture in the context analyzed.

Predictive relevance was evaluated using the Stone–Geisser  $Q^2$  statistic. All  $Q^2$  values were greater than zero, with a  $Q^2$  value of 0.43 for organizational safety culture. This result

confirms that the model has strong predictive capability and is suitable for explaining and predicting safety culture outcomes in similar organizational settings.

### 4.3 Hypothesis testing

Hypothesis tests were carried out on the magnitude, direction and statistical significance of the calculated path coefficients.

H1: Value-based human factors have a significant positive effect on organizational safety culture. The results support this hypothesis, as the path coefficient from value-based human factors to organizational safety culture is positive and statistically significant ( $\beta = 0.38, p < 0.01$ ).

H2: Value-based human factors have a significant positive effect on safety-oriented work behavior. The analysis provides strong support for this hypothesis, with a significant positive relationship between value-based human factors and safety-oriented work behavior ( $\beta = 0.47, p < 0.001$ ).

H3: Safety-oriented work behavior mediates the relationship between value-based human factors and organizational safety culture. Evidence for this hypothesis is provided by the mediation analysis presented in the following subsection.

The hypothesis testing results confirm that value-based human factors function as important antecedents of both safety-oriented work behavior and organizational safety culture, and that behavioral mechanisms play a critical role in translating values into safety outcomes.

### 4.4 Mediation analysis

To examine the mediating role of safety-oriented work behavior, indirect effects were tested using the bootstrapping procedure with 5,000 resamples. The mediation analysis focused on whether safety-oriented work behavior transmits the effect of value-based human factors to organizational safety culture. The results of the mediation analysis are summarized in Table 5.

**Table 5.** Mediation analysis results

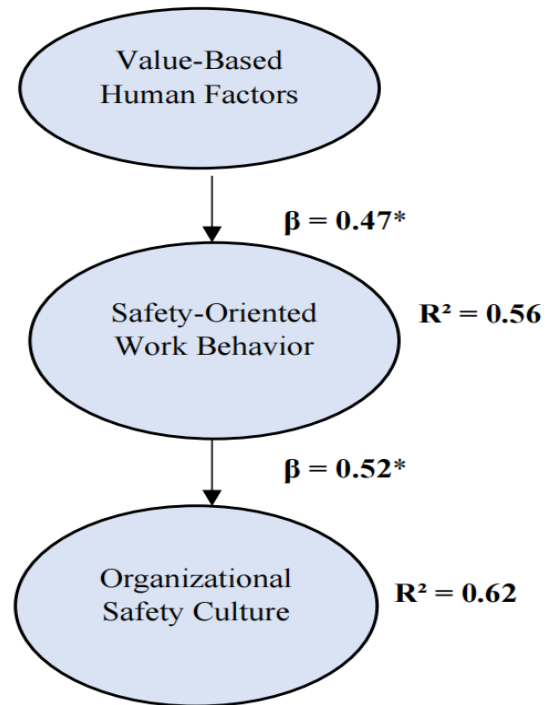
Relationship	Direct Effect ( $\beta$ )	Indirect Effect ( $\beta$ )	Mediation Type
Value-based human factors → Safety-oriented work behavior → Organizational safety culture	0.38	0.24	Partial mediation

The indirect effect of value-based human factors on organizational safety culture through safety-oriented work behavior is positive and statistically significant ( $\beta = 0.24$ ). This indicates that a substantial portion of the influence of values on safety culture operates through employees' safety-related behaviors.

At the same time, the direct effect of value-based human factors on organizational safety culture remains statistically significant when the mediator is included in the model ( $\beta = 0.38$ ). This pattern indicates partial mediation, meaning that value-based human factors influence safety culture both directly and indirectly through behavioral mechanisms.

Partial mediation suggests that safety culture is shaped not only by observable safety behaviors but also by deeper value-

based orientations that influence shared interpretations of safety priorities, ethical responsibility, and leadership commitment. Values therefore, function both as drivers of behavior and as foundational elements of organizational culture.



**Figure 1.** Structural model with standardized path coefficients

Figure 1 illustrates the relationships among value-based human factors, safety-oriented work behavior, and organizational safety culture. Standardized path coefficients ( $\beta$ ) are displayed for all significant relationships, with arrows indicating the direction of influence among constructs.

### 4.5 Summary of results

In summary, the PLS-SEM analysis offers strong empirical support for the human factors model of value-based safety culture. The measurement model shows high reliability and validity, ensuring that the constructs are measured accurately and consistently. The structural model shows that value-based human factors influence the organization's safety-oriented work behavior and safety culture, with strong explanatory and predictive capabilities.

Safety-oriented work behavior is the most powerful predictor of the organization's safety culture and serves as a basic mediation mechanism for turning values into collective safety norms. At the same time, value-based human factors exert a direct influence on safety culture, highlighting the importance of ethical and professional values as foundational drivers of safety in high-risk organizational environments.

These findings offer a solid empirical basis for the discussion, including the theoretical contributions and practical implications.

## 5. DISCUSSION

This part interprets the empirical results in relation to

research hypotheses, places the results in the existing literature, and analyzes their impact from the perspective of human factors and risk management [27]. The discussion concludes by highlighting the broader safety implications for complex and high-risk organizations.

### 5.1 Interpretation of findings in relation to the hypotheses

The empirical results provide strong support for the hypotheses and confirm the validity of the human factors model based on the values developed in this study. The significant direct effect of value-based human factors on organizational safety culture supports Hypothesis 1, demonstrating that ethical and professional values shape shared safety norms and perceptions at the organizational level [28]. This finding indicates that safety culture is derived not only from formal safety systems and leadership directives but also from value orientations that regulate the collective understanding of acceptable safety practices within the organization.

An important finding of the structural model is that safety-oriented work behavior shows a stronger direct influence on organizational safety culture ( $\beta = 0.52$ ) than the direct effect of value-based human factors ( $\beta = 0.38$ ). This difference suggests that values may exert their influence primarily through observable workplace practices rather than through abstract cultural alignment alone. In the context of Indonesian SOEs, institutionalized values such as those embedded in the AKHLAK framework are frequently communicated through formal training and policy directives. However, the transformation of these values into a shared safety culture appears to occur most strongly when they are translated into concrete, peer-to-peer behaviors such as reporting hazards, supporting colleagues in safe practices, and reinforcing safety norms during daily operations. In this sense, safety-oriented work behavior functions as the practical mechanism through which values become visible and collectively reinforced within the organization. This interpretation aligns with behavioral perspectives on safety culture development, which emphasize that repeated safety practices and interpersonal reinforcement are essential for transforming organizational values into stable cultural norms.

The results provide strong support for Hypothesis 2, confirming a significant positive relationship between value-based human factors and safety-oriented work behavior. Employees who internalize organizational values are more likely to engage in behaviors that promote safety, including procedural compliance, proactive hazard communication, and participation in safety initiatives [29]. This finding reinforces the view that values function as internalized behavioral guides, particularly in operational contexts where formal rules alone cannot fully regulate safe action.

Mediation analysis provides empirical support for Hypothesis 3, showing that safety-oriented work behavior partly mediates the relationship between value-based human factors and the safety culture of the organization. This result explains the mechanism by which values are translated into cultural outcomes. Value-based human factors indirectly influence safety culture by shaping everyday safety behaviors and also exert a direct effect through the ethical climate, leadership expectations, and interpersonal trust. The coexistence of direct and indirect effects highlights the multilevel and dynamic development of safety culture.

### 5.2 Comparison with prior studies

Previous studies underscore the importance of human factors and ethical guidelines in shaping safety management practices. Previous studies have shown that ethical climates characterized by integrity, accountability, and trust are positively related to safety compliance, participation, and reporting behavior [7]. This research extends this literature by showing how values shape safety culture through a mechanism of behavioral mediation, rather than treating values as static contextual variables.

Prior human factors research has also highlighted the importance of competence, communication, and teamwork in reducing operational risk [14]. The strong relationship between value-based human factors and safety-oriented work behavior is consistent with these findings, suggesting that safety performance depends on organizationally shared meanings and practices, not solely on technical controls. However, this study advances the literature by integrating values, safety behavior, and safety culture into a single empirical model and testing those relationships.

Compared to studies focusing primarily on leadership or safety climate, the present research offers a more comprehensive explanation of safety culture by explicitly incorporating ethical values as upstream antecedents [30]. This integrated approach responds to calls for models that account for the interaction between moral, behavioral, and organizational dimensions of safety.

### 5.3 Human factors perspective

From a human factors perspective, the findings underscore the importance of ethical and value-based dimensions in shaping human reliability. Traditional human factors models emphasize cognitive processes, technical skills, and communication; however, the present results demonstrate that values such as trustworthiness, competence, adaptability, and collaboration significantly influence how individuals interpret safety rules and make decisions under uncertainty.

Value-based human factors enhance safety by guiding behavior in situations where procedures are ambiguous, incomplete, or subject to competing goals [31]. Employees who internalize ethical and professional values are more likely to exercise judgment that prioritizes safety, even in the absence of direct supervision. This contributes to resilient human performance, particularly in complex systems where adaptability and coordination are essential.

The mediating role of safety-oriented work behavior further emphasizes the behavioral nature of human factors. Values influence safety outcomes primarily through their impact on routine practices and interactions. This finding supports the conceptualization of human factors as dynamic processes embedded in organizational routines rather than as isolated individual attributes.

### 5.4 Risk management perspective

From a risk management perspective, the results indicate that value-based human factors operate as complementary “soft controls” within organizational safety systems. Formal safety management systems rely on procedures, training, and technical safeguards to control risk; however, these elements alone cannot fully address the variability and uncertainty inherent in complex operations.

Value-based human factors influence how employees respond to risk in situations where formal controls are insufficient. By strengthening accountability, ethical responsibility, and collaboration, values enhance the effectiveness of existing safety controls and reduce reliance on reactive measures [32]. The substantial explanatory power of the model suggests that integrating values into risk management strategies can meaningfully improve safety culture and reduce organizational risk exposure.

The observed partial mediation also implies that effective risk management interventions should target both values and behavior. Safety culture initiatives are likely to be most effective when ethical frameworks are reinforced through behavioral expectations, leadership practices, and organizational systems that support safe action.

### 5.5 Broader safety implications

The broader safety implications of this study are particularly relevant for large, complex, and high-risk organizations. The findings demonstrate that standardized value frameworks can function as unifying mechanisms that align safety behavior across diverse operational units [33]. This is especially important in organizations with heterogeneous risk profiles, where consistency in safety practices is difficult to achieve through rules alone. The results suggest that the development of safety culture should be understood as a long-term organizational process, rather than a short-term compliance exercise [34]. Values provide a stable foundation for sustained behavioral change and continuous learning [35]. When embedded in training, leadership development, and performance management systems, value-based human factors can support proactive safety cultures that anticipate and manage risk rather than merely reacting to incidents.

While the findings are robust within the studied context, they should be interpreted as evidence of a mechanism rather than as universally prescriptive solutions [36]. Nonetheless, the demonstrated relationships between values, behavior, and safety culture provide a strong basis for further research and practical application in comparable organizational settings.

Organizations that want to strengthen safety culture should go beyond compliance approaches and integrate value-based strategies into training programs, leadership development initiatives, and performance management systems. Explicitly linking organizational values to concrete safety behaviors can enhance accountability, improve communication, and reinforce collective responsibility for safety [37]. In large and complex organizations, shared value frameworks can help align safety practices across diverse operational units and support more consistent and proactive risk management.

### 5.6 Contextual considerations in Indonesian state-owned enterprises

It is important to consider the contextual nature of the findings when interpreting the role of AKHLAK values as value-based human factors. In Indonesian SOEs, the AKHLAK framework is not merely an organizational initiative but a nationally mandated value system that is formally embedded in governance structures, training programs, and performance management practices. This institutionalized and top-down implementation may strengthen the visibility and behavioral influence of these values within daily work practices. In organizational contexts

where value systems emerge more organically, such as private-sector firms in Western economies, the mechanisms through which values influence safety behavior and safety culture may differ. The effectiveness observed in the present study may therefore partly reflect the structured and institutionalized nature of AKHLAK within Indonesian SOEs. Future research could examine whether similar value-based human factor mechanisms operate in organizations where value systems develop through bottom-up cultural processes rather than formal institutional mandates.

## 6. CONCLUSIONS

This study examined the role of value-based human factors in shaping organizational safety culture in an Indonesian state-owned enterprise. The results demonstrate that value-based human factors significantly influence safety culture both directly and indirectly through safety-oriented work behavior, with behavioral mechanisms showing the strongest explanatory power. These findings contribute to safety culture research by integrating culturally grounded value systems into a human factors framework and empirically demonstrating how organizational values translate into safety outcomes through observable workplace behaviors.

Theoretically, this research advances safety culture scholarship by empirically integrating value-based human factors into a predictive model of safety culture. By positioning values as upstream antecedents and safety-oriented work behavior as a mediating mechanism, the study provides a more nuanced explanation of how safety culture is developed and sustained. It also contributes to cross-cultural safety research by demonstrating how culturally grounded value frameworks can be linked to generalizable safety mechanisms.

Several limitations should be acknowledged. The study was conducted in a single organizational context, which may limit generalizability. The cross-sectional design limits causal inference, and reliance on self-reported data may introduce common method bias. In addition, the aggregation of value-based human factors into a single construct may obscure the distinct effects of individual value dimensions.

Future research should examine the model across industries and organizational types, apply longitudinal designs, disaggregate value dimensions, and incorporate objective safety performance indicators. Exploring moderating factors such as leadership style, organizational learning capability, or technological safety systems may further enrich understanding of how value-based human factors interact with other elements of safety management.

In conclusion, this study demonstrates that value-based human factors constitute a critical foundation for organizational safety culture. By empirically linking values, behavior, and culture, the research provides both theoretical insight and practical guidance for developing resilient and ethically grounded safety management systems in complex organizational environments.

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## APPENDIX

### Survey Questionnaire

The following appendix presents the questionnaire items used in this study. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The items were adapted from established measurement scales and adjusted to reflect the organizational context of Indonesian state-owned enterprises.

#### *Amanah (Trustworthiness)*

1. I fulfill my work responsibilities with integrity.
2. I consistently honor commitments made in my work role.

#### *Kompeten (Competence)*

3. I continuously develop my professional skills.
4. I apply my knowledge to perform tasks safely and effectively.

#### *Harmonis (Harmony)*

5. I maintain respectful relationships with colleagues.
6. I contribute to a supportive work environment.

#### *Loyal (Loyalty)*

7. I prioritize organizational interests in my work decisions.
8. I remain committed to organizational goals.

#### *Adaptif (Adaptability)*

9. I adjust my work practices when safety conditions change.
10. I remain responsive to new safety challenges.

#### *Kolaboratif (Collaboration)*

11. I cooperate effectively with colleagues when performing work tasks.
12. I actively share information related to safety issues.

### **Section B: Safety-Oriented Work Behavior**

13. I always follow established safety procedures during my work tasks.

14. I report unsafe conditions when they occur.

15. I encourage colleagues to follow safety practices.

16. I participate in workplace safety initiatives.

### **Section C: Organizational Safety Culture**

17. Safety is a priority in my organization.

18. Management actively promotes safe work practices.

19. Employees openly discuss safety concerns. organization.
20. Learning from safety incidents is encouraged in this