# Occupational Safety and Health and Employee Performance in Indonesia, India, and Brazil

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*Abstract:* - The present investigation assesses the reciprocal influence of economic, health, and occupational safety and health determinants upon labour performance in Brazil, India, and Indonesia, deploying the Autoregressive Distributed Lag (ARDL) Panel methodology. The central inquiry determines the degree to which the aforementioned variables contribute to enhancing employee productivity. Quantitative results consistently demonstrate that a simultaneous rise in economic robustness, health metrics, and the enactment of dedicated occupational safety and health programmes materialises in marked gains in worker performance. Short-term observations suggest that well-designed safety and health protocols reduce accident prevalence and enhance job satisfaction, thereby increasing labour productivity. Health indicators—specifically, reduced neonatal mortality and broader access to healthcare—exert comparable beneficial pressures. Fiscally, indices comprising elevated GDP per capita, reduced unemployment, and dampened inflation collectively produce a stable workplace milieu, which in turn is positively aligned with performance. An extended temporal assessment, undertaken via the ARDL framework, substantiates the persistence of these relationships; the parameters maintain their effectual relevance across multiple observation windows. This persistence underlines their systemic robustness. The investigation yields pragmatic direction for managerial and organisational executives, underscoring the imperative of instituting comprehensive occupational safety and health practices, advancing public health indices, and securing macroeconomic stability as requisite levers for sustained enhancement of employee performance. The present investigation further delineates substantive trajectories for subsequent research, most notably the empirically grounded examination of latent variables that mediate or moderate individual-level performance outcomes, as well as the design of granular interventions calibrated to enhance workplace safety, well-being, and economic resilience within the heterogeneous institutional and cultural configurations characterising diverse national contexts.

*Key-Word:* - Occupational Safety, Health, Economy, Employee Performance, Economic Stability, ARDL Panel, Productivity.

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## 1 Introduction

Safety and health at work (OSH) are the most crucial enablers of increased productivity across various industrial sectors. The direct attenuation of workplace accident rates is, of course, an important advantage; nonetheless, the concurrent promotion of workers' physical and psychological well-being arguably generates an even larger and enduring dividend. Improved health fosters greater concentration and resilience, yielding productivity gains that, in terms of efficiency and quality, often dwarf the initial investments in OSH infrastructure, [1], [2]. Nations of the Global South, including Indonesia, India, and Brazil, have recently embedded OSH as a linchpin of strategic workplace productivity; yet, an equally widespread and frequently recalcitrant hurdle persists in the inconsistent and frequently incomplete execution of publicly and privately sponsored OSH programs, [3].

A secure workplace is a powerful motivator for employees and fosters a sense of esprit de corps. Workers who perceive the workplace as secure and well-regarded in its health policies are more inclined to invest emotional and cognitive labour in their roles; loyalty, which is a cumulative product of perceived fairness, is thereby fortified, [4]. Consequently, longitudinal datasets surveyed by [5] and corroborated by [6] document that firms demonstrating systematic and comprehensive OSH investment exhibit statistically significant gains in

overall employee productivity, a marked reduction in unscheduled absenteeism, and a parallel increase in reported job satisfaction. The frictional, often under-reported costs of workplace injury—in the form of medical correction, retraining of damaged employees, residual damaged morale, and productivity stall—can, one case study after another, be materially attenuated by the routine deployment of systematic and well-communicated OSH standards, [6].

Notwithstanding the extensive inquiries that have examined the relationships between occupational safety and health (OSH) initiatives and employee performance, exemplified by [7] and [8], the prevailing evidence base remains insubstantial. A conspicuous lacuna is the virtual absence of comparative analyses that position OSH paradigms against economically and culturally heterogeneous settings, as is the case with Brazil, India, and Indonesia. Relatedly, numerous investigations purport to disentangle OSH influences by isolating single dimensions, as seen in the inquiries of [9] and [10]; however, these works fail to encompass the configurative interaction of health and economic indices and their concomitant effect on performance trajectories. Empirical consensus suggests that occupational climates in which personnel perceive safety and organisational esteem correlate positively with dedication and affective commitment. Quantified avenues directing efficacious OSH arrangements further reinforce that implementation not only ameliorates employee morbidities but also concurrently attenuates financial liabilities, specifically medical expenditure and the opportunity cost of reduced productivity otherwise borne by organisations, as articulated in [11]. OHS can also contribute to increased productivity and operational efficiency, thereby improving employee performance and company profits, [12]. Workers who feel secure and appreciated at work are more likely to be devoted to the organization and to be loyal to it, [13]. Therefore, it is important for companies to continuously invest in effective OSH programs and to raise awareness and training about the importance of these practices at all levels of the organization, [14].

Both theoretical and practical gains are anticipated from this study. In practice, the study's conclusions can benefit managers and organizational leaders in Brazil, India, and Indonesia to create and carry out successful OSH initiatives. By understanding how OSH, health indexes, and economic indexes influence employee performance, managers can make more accurate and strategic decisions to increase productivity and efficiency in the workplace. This study will theoretically add to the corpus of information presently available on OSH and its impact on worker performance, especially in a comparative context between countries. Further research on other variables that could affect the connection between OSH and worker performance may also be made possible by this study.

This research uses the ARDL Panel approach to analyze data obtained from the World Bank, which includes indicators such as labor productivity, workplace accident rates, OSH training programs, health indexes, and economic indexes. The selection of these variables is based on existing literature and their relevance in the context of OSH and employee performance. Descriptions of the countries studied, namely Indonesia, India, and Brazil, will provide a deeper context regarding the economic, social, and cultural conditions that affect the implementation of OSH in each country.

In conducting this research, the data obtained will be analyzed to test the proposed hypotheses, specifically that OSH has a favorable impact on worker performance, as do economic, health, and occupational safety and health (OSH) dimensions. The study's findings should demonstrate the strong correlations between OSH and worker performance as well as the ways in which economic and health indices affect these correlations. By comparing the research results in Indonesia, India, and Brazil, this study can identify best practices and challenges faced in the implementation of OSH in each country.

This research is expected to provide practical guidelines for managers and organizational leaders in developing and implementing effective OSH programs, as well as add to the existing literature on OSH and its impact on employee performance, especially in a comparative context between countries. It is anticipated that this study will open the door for future research and improved policy creation by shedding light on the ways in which economic, health, and OSH indices affect worker performance. As a result, OSH is crucial for raising employee performance, and this study should significantly advance initiatives to raise OSH and employee performance across a range of nations with diverse contexts.

## 2 Literature Review

Occupational safety and health are crucial aspects of creating a safe environment. This approach

includes various efforts aimed at preventing work-related accidents and illnesses by identifying and controlling existing risks. The significance of safety and health in the workplace plays an important role in supporting employee well-being, which ultimately affects their performance. A healthy and safe workplace can enhance the motivation, morale, and productivity of workers, while simultaneously reducing absenteeism and turnover rates, [8].

Employee performance is the outcome of carrying out their tasks and obligations. This aspect is measured through various indicators such as productivity, efficiency, quality of work output, and target achievement. Various factors influencing employee performance include physical and mental conditions, work environment, and external factors such as economic and social situations. Studies indicate that workers in supportive and safe working conditions tend to have better performance compared to those in less supportive conditions, [15].

The literature now in publication demonstrates the significance of OSH. The risk of work-related accidents that cause serious injury or even death can occur in the workplace, so implementing effective OHS measures to protect workers from risks is important, [16].

Research by [17] states that work-related accidents and occupational diseases affect millions of workers every year worldwide. This study highlights the importance of taking preventive measures by implementing efficient workplace safety and health regulations. Companies that invest in worker safety and health programs also tend to perform better financially.

[18] explain that companies that take occupational safety and health programs seriously experience increased production and cost efficiency. Investment in occupational safety and health provides significant financial benefits to companies.

[19] show that good safety standards have an impact on increasing the competitiveness of companies in the market. Companies with a strong safety culture are more likely to attract and retain high-quality employees.

A recent investigation conducted by [20] supports the position that the systematized application of safety management protocols is correlated with both decreased incidence of occupational incidents and heightened employee morale. The argument is advanced that the presence of a well-ordered safety environment fosters a perception of esteem and encouragement among workers, conditions that, in turn, promote higher productivity levels and lower rates of unscheduled absence.

A parallel study by [21] emphasizes the need to tailor occupational health and safety standards to regional realities and the overarching legislative framework of the state. The resonance of safety and health interventions is sensitive to a nation's prevailing economic profile and the norms embedded in its work culture.

Evidence from [22] establishes that occupational safety and health regimes serve a dual purpose: the first is to shield the workforce from injuries and illnesses, and the second is to enhance the productivity and economic viability of the enterprise. Effectively crafted OSH interventions can, among other things, enhance employee well-being, reduce expenditures arising from accidents, and improve overall operational efficiency. Within various manufacturing, service, and extractive environments, the allocation of resources earmarked for OSH is a prudent strategic decision.

The efficacious deployment of occupational safety and health programs is predicated on the concerted effort of all relevant actors, including managerial levels and line operatives. Management is responsible for allocating both financial and physical resources to OSH initiatives, encompassing employee training, the provision of personal protective equipment, and the establishment of health-supportive facilities [23]. Equally, management is obliged to supervise adherence to safety procedures and to instill a culture that comprehends the intrinsic and extrinsic value of preserving health and safety in workplace settings.

The proactive engagement of workers is indispensable not only for hazard surveillance but also for the systematic mitigation of risk within the workplace. Such contributions reinforce the social legitimacy of occupational safety and health (OSH) initiatives and secure durable adherence when workers are included as co-designers rather than merely as targets [24].

An operational definition of employee performance must account for the multifaceted outputs mandated by defined roles and obligations. Metrics such as productivity volumes, operational efficiencies, defect rates, and the extent of goal fulfilment are routinely drawn upon, each reflecting distinct components of an employee’s effectiveness. The persistence of performance fluctuations is attributable to an array of interdependent determinants, including individual health profiles, organisational climate, and broader

macroeconomic and sociocultural currents, [25]. Empirical evidence consistently suggests that stabilized performance is most achievable under collaborative, risk-averse, and health-facilitative organizational models. Consequently, a spectrum of theoretical perspectives is being progressively elaborated to link OSH provisions to specific performance mechanisms, thereby refining the explanatory and normative accounts furnished by existing research. The following theories were developed in light of the literature review:

Hypothesis 1 (H1): Occupational safety and health have a positive effect on employee performance.

Hypothesis 2 (H2): Health index has a positive effect on employee performance.

Hypothesis 3 (H3): Economic index has a positive effect on employee performance.

## 3 Research Method

The research uses the Panel Autoregressive Distributed Lag (ARDL) technique. This approach is very suitable for research involving several countries with different economic and social characteristics. We use the following econometric model.

$$EP_{it} = \alpha_i + \beta_1 OHS_{it} + \beta_2 HI_{it} + \beta_3 EI_{it} + \varepsilon_{it}$$

where,
EP is the employee performance
OHS is Occupational safety and health
HI is the Health Index
EI is the Economic Index
$\alpha_i$ is a country-specific Intercept
$\beta_1$, $\beta_2$, $\beta_3$ is the regression coefficient
$\varepsilon$ is the Error term
$_{it}$ is in country i at time t

The ARDL model may be expressed as follows

$$\Delta EP_{it} = \alpha_i + \delta_1 EP_{it-1} + \sum_{j=0}^{p} \phi_{1j} \Delta OHS_{it-j} + \sum_{j=0}^{p} \phi_{2j} \Delta HI_{it-j} + \sum_{j=0}^{p} \phi_{3j} \Delta EI_{it-j} + \lambda 1\, OHS_{it-1} + \lambda 2\, HI_{it-1} + \lambda 3\, EI_{it-1} + \varepsilon_{it}$$

In this ARDL model, $\Delta$ indicates the change in the variable, p,q,r indicate the appropriate lag length for each independent variable, The short-term coefficients are denoted by $\phi$ij, whereas the long-term coefficients are denoted by $\lambda$i.

The initial step of our research is to test the stationarity of the variables using the unit root test, namely Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF). The next step is to identify the optimal lag for the ARDL model using information criteria, namely the Akaike Information Criterion (AIC) or the Schwarz Information Criterion (SIC) to find the most appropriate number of lags for data analysis.

Identifying a persistent equilibrium among the variables warrants the implementation of a cointegration procedure, for which the Pedroni or Kao test is employed. If evidence of cointegration is established, the subsequent operation involves estimating the Error Correction Model (ECM) to capture the dynamic adjustment mechanism toward the long-run equilibrium.

The empirical analysis is structured around a triplet of dimensions: occupational safety and health (OHS) indicators, a composite health index, an economic index, and the proxy for employee performance. The geographical scope covers Indonesia, India, and Brazil. Data accessibility is safeguarded by leveraging World Bank datasets, recognized for their broad geographical and sectoral reach, as well as their methodologically rigorous data collection protocols, which jointly enhance the reliability and external validity of the ensuing empirical findings.

Within the analytical framework, employee performance is posited as the dependent variable. Operationalization is carried out through quantitative indicators encompassing labor productivity metrics, operational efficiency ratios, and the attainment of pre-established performance thresholds. The explanatory block is truncated to three constructs: the suite of K3 protocols, the composite health index, and the economic index. The relevant definitions and summarized descriptive statistics for the variables are presented in Table 1 (Appendix).

The anticipated contributions of the analysis are of substantive relevance. The projected findings are expected to deepen theoretical and operational understandings of the interrelations linking occupational safety and health measures, the compiled health and economic indices, and the observable performance of employees in the divergent institutional and economic contexts of Indonesia, India, and Brazil. Consequently, the research presented herein provides senior managers and organizational leaders with actionable guidance for designing and operationalizing adequate occupational safety and health (OSH) initiatives, as well as for enhancing firm productivity and operational efficiency. Through the systematic analysis of OSH deployment across diverse settings, the investigation elucidates the

mechanisms by which safety interventions modulate employee performance, providing decision-makers with evidence-based perspectives that facilitate tailoring OSH strategies to situational exigencies.

## 4 Research Results and Discussion

A thorough summary of the connection between the independent and dependent variables in the present research is given by the many tables that display the data analysis results using the ARDL Panel model. These tables cover various aspects of the analysis. The descriptive statistics table presents basic data from the variables studied, providing an overview of the distribution and variability of the data. The results of the stationarity test are displayed to ensure that the variables used do not have trends that can produce misleading results. The selection of the optimum lag using the AIC determines the most appropriate number of lags for the analysis, helping to capture the temporal dynamics of the data more accurately. The ARDL model estimation itself provides coefficients that indicate the magnitude and direction of the influence of the independent variables on the dependent variables in the short and long term. The purpose of the cointegration test is to determine whether there is a stable, long-term link between the variables under study. The test's findings show whether the variables move in tandem over time. After a deviation, short-term adjustments towards long-term equilibrium take place, as explained by the estimation of the ECM. By assessing the existence of autocorrelation, heteroscedasticity, and a normal distribution of residuals, diagnostic tests guarantee the model's validity and dependability. Finally, a comparison of the results across the three countries provides insight into how these variables interact with each other in Indonesia, India, and Brazil, revealing similarities and differences in their effects on employee performance across different economic and social contexts. The descriptive statistics are shown in Table 2 (Appendix).

An overview of the fundamental statistics of the variables employed in this investigation is provided in Table 2 (Appendix), providing an overview of the distribution and variation of the data. In the variable Employee performance, the mean is 3.45 with a median of 3.50, indicating that most employee performance scores fall around this value. The very limited variance in employee performance throughout the sample is indicated by the standard deviation of 0.65, meaning that most employees perform close to the mean. The min and max values are 2.00 and 4.50, indicating a range of employee performance scores from the lowest to the highest in this sample. This indicates that although there are some differences in performance, employees generally demonstrate a fairly consistent level of performance. For the variable the OSH, the mean is 2.80 with a median of 2.75. Table 3 (Appendix) shows Stationarity Test Results (ADF Test)

This stationarity test is important to ensure that the data used in the econometric analysis does not have an inappropriate trend, which can lead to misleading results. To determine if the variables are stationary at the level or require differencing to attain stationarity, the ADF test is conducted at the level and first difference. The p-value for the employee performance variables is 0.455, indicating that it is not significant at the typical levels of 1%, 5%, or 10%. This indicates that the Variables of Employee performance is not stationary at the level. At the 1% level, the p-value is extremely significant at 0.001 after differencing once (first difference). This shows that after differencing once, the variables affecting employee performance become stable. Thus, for further analysis, these variables must be differencing once to achieve stationarity.

The OSH variables show a p-value of 0.670 at the level, which is not significant. This indicates that these variables are not stationary at the level. However, after differencing once, the p-value becomes 0.000. Table 4 (Appendix) presents the result of the AIC.

The results of the ideal lag selection in the ARDL model using the Akaike Information Criterion (AIC) are shown in Table 4 (Appendix). The AIC value decreases as the number of lags increases up to lag 4. The lowest AIC value is -2.612 at lag 4 which is marked with an asterisk (*). This shows that the ARDL model with lag 4 is the most optimal model to use in this analysis. The decrease in the AIC value as the number of lags increases indicates that each additional lag up to lag 4 provides additional information that improves the model's fit to the data. This finding encourages more research to determine how these factors combine and impact worker performance in Brazil, India, and Indonesia. Table 5 (Appendix) presents the ARDL model estimates.

The cointegration test results utilizing the ARDL model are displayed in Table 5 (Appendix). The purpose of the cointegration test is to determine if the variables under study have a stable, long-term connection. Panel v-Stat, rho-Stat,

PP-Stat, and ADF-Stat are the four primary statistics utilized in this context; each has a distinct value and degree of importance.

With a p-value of 0.089, Panel v-Stat has a value of 1.345. There is not enough evidence to indicate a long-term association between the variables in this test, since this result is not significant at traditional levels (e.g., 5% or 1%).

Panel rho-Stat is also not significant, with a p-value of 0.110 and a value of -1.235. Accordingly, there is no compelling evidence to indicate the presence of cointegration between the variables under investigation, according to this test.

Nonetheless, Panel PP-Stat and Panel ADF-Stat produced noteworthy findings. These findings are important for policy-making and management strategies in improving employee productivity and welfare in various economic contexts. Table 6 (Appendix). Cointegration Test (Pedroni Test).

To determine if there is a long-term link between the variables under study, the cointegration test results using the Pedroni Test are shown in Table 6 (Appendix). Panel v-Stat, rho-Stat, PP-Stat, and ADF-Stat are the primary statistics utilized in this context.

With a p-value of 0.089, Panel v-Stat has a value of 1.345. This result is not significant at conventional levels (often 5% or 1%), although displaying a rather big number. This demonstrates that there is insufficient evidence of a long-term link or cointegration between the variables examined in the Panel v-Stat test.

Panel rho-Stat is also not significant, having a p-value of 0.110 and a value of -1.235. This indicates that there isn't any solid proof of cointegration between the variables under study in this test. Table 7 (Appendix) presents the Error Correction Model (ECM) Estimates.

Table 7 (Appendix) provides the estimation results of the ECM. The OSH variables have a positive and significant influence at the 1% level, as indicated by the short-term coefficient of 0.315, t-statistics value of 2.670, and significance level of 0.009. This indicates that an expansion of the OSH program immediately improves employee performance.

The short-term Health Index has an t-Statistics Value of 2.100, a Coefficient of 0.125, and a significance level of 0.037. At the 5% level, these findings show a favorable and substantial effect. This indicates that short-term increases in the Health Index, such as better access to healthcare and lower rates of disease, have a favorable effect on worker performance.

The Economic Index in the short term shows a Value t-Statistics of 2.015, and a Significance level of 0.045, which indicates a positive and significant effect at the 5% level. The analysis confirms that favorable macroeconomic indicators such as sustained economic stability and persistently low unemployment have a measurable positive effect on employee productivity over short horizons. In the long term, however, determinants attributable to systemic occupational safety and health (OSH) variables emerge as the more robust predictors of sustained performance. The respective econometric model yields a t-statistic of 4.210 and a significance level of 0.000, thereby establishing, at a 1% level of confidence, that the enduring structuring of OSH programmes is associated with a durable performance advantage. The results suggest that when OSH initiatives are consistently integrated into corporate strategy, positive behavioral and productivity shifts persist beyond the fluctuations of the economic cycle.

Complementary estimates of a Health Index, integrated as a second regressor, exhibit a coefficient of 0.395, a t-statistic of 3.450, and a significance of 0.002. The thresholds achieved once again support the 1% significance criterion, indicating that progressive enhancement of occupational health parameters yields constrained improvements over longer horizons of productivity. The overall findings collectively underscore the importance of strategic, enduring, and systematic OSH and health investments as key determinants of long-term employee performance. Economic Index in the long-term has a Coefficient of 0.335, Value t-Statistics 3.100, and a Significance level of 0.004, which shows a positive and significant effect at the 1% level. This shows that good economic conditions will continuously have a significant positive impact on Employee performance in the long term. The Coefficient for the error correction term (ECT) of -0.735 with a Value t-Statistics of -4.850 and a Significance level of 0.000 indicates that there is a rapid adjustment to the long-term balance when there is a deviation from the equilibrium Value. The negative and significant value of ECT indicates that about 73.5% of the imbalance in the previous period was corrected in the current period. This shows that this model has a fast and effective correction dynamic against short-term deviations toward long-term equilibrium. Overall, the ECM estimation results show that OSH, Health Index, and Economic Index have a significant positive effect on Employee performance, both in the short-term and long-term. This finding emphasizes the importance of

implementing sustainable programs in the OSH, increasing the Health Index, and stable economic conditions to achieve optimal Employee performance improvements. Table 8 (Appendix) presents the diagnostic test

The findings of the diagnostic procedures utilized to confirm the reliability and validity of the estimated model in this investigation are shown in Table 8 (Appendix). Three diagnostic tests are conducted: the residual normality test, the autocorrelation test, and the heteroscedasticity test.

The autocorrelation test yielded a p-value of 0.186 and statistics of 1.320. This means that the model residuals do not show an autocorrelation pattern, indicating that this model has no problems with autocorrelation and that the assumption of residual independence is met.

With a p-value of 0.420, the statistics for the heteroscedasticity test are 0.875. This demonstrates that there is no unsettling heteroscedasticity issue and that the residuals' variance stays constant, which means that the assumption of homoscedasticity (uniformity of residual variance) is met in this model. Table 9 (Appendix). Show Comparison of Results in Various Countries

Table 9 (Appendix) presents a comparison of the influence of K3, Health Index, and Economic Index on Employee Performance in Indonesia, India, and Brazil. The coefficients displayed indicate the level of influence of the independent variables on Employee Performance in each country, with an asterisk indicating the level of significance.

In Indonesia, the K3 Coefficient of 0.425 indicates a significant positive influence on Employee Performance at the 1% level. This indicates that improving the K3 program significantly improves Employee Performance. The Health Index also has a significant positive influence with a Coefficient of 0.215 at the 5% level, indicating that better health conditions contribute positively to Employee Performance. The Economic Index report shows a p-value of 5%, suggesting that advantageous national economic conditions exert a robust and positive influence on Employee Performance across the country. The Employee Performance in the Indian cohort recorded a mean of 3.60 on the relevant evaluative scale, indicating a substantial level of workplace efficacy.

Further, the Indian K3 coefficient, registering at 0.390 and validated at the more stringent p-value of 1%, confirms a positive, albeit marginally weaker, contribution to Employee Performance when juxtaposed with the parallel Indonesian data. Concurrently, the Health Index coefficient, calibrated at 0.200 and exhibiting a p-value of 5%, affirms that enhancements in workforce health parameters correlate with elevated Performance levels. The econometric specification also incorporates a coefficient of 0.175 for the Economic Index, validated at the identical p-value of 5%, reiterating that sound economic conditions confer parallel Performance advantages. The corresponding mean Performance assessment in the Indonesian sample is 3.45, suggesting a comparative but invariantly robust level of Employee efficacy. Brazilian data present a salient K3 coefficient of 0.410, significant at the 1% threshold, thereby asserting that expanded Occupational Safety and Health across the Brazilian manufacturing sector substantiates a considerable Performance uplift. A Health Index coefficient of 0.210, significant at the 5% level, corroborates that enhanced health interventions in Brazil exert parallel but more modest benevolent effects. The Economic Index with a Coefficient of 0.180 and a Significance level of 5% also indicates that good economic conditions contribute positively to Employee performance. The average Employee performance score in Brazil is 3.50, which is between the scores of Indonesia and India.

## 5 Discussion

In order to increase employee OSH, this study highlights the need for a safety culture and proper training, which in turn increases productivity and performance. According to a study by [20], Employee motivation and performance are likely to be higher in a safe and healthy work environment than in a hazardous one.

However, some studies have found conflicting results. For example, research by [26] shows that even though the OSH program is implemented, its effect on Employee performance is not always significant. Research by [27] states that the success of the OSH program is highly dependent on management commitment and active employee participation. Without strong support from both parties, Employee performance may not be significantly impacted by the OSH program's implementation.

Additionally, it was shown that the Health Index significantly improved employee performance. At the 5% level in the short term and the 1% level in the long term, the Health Index Coefficient displays a positive and significant value. This shows that good health conditions, as reflected in low infant mortality rates, low disease

prevalence, and good access to health services, can improve the physical and mental conditions of employees, which in turn improves their performance.

This finding is in line with previous research by [28], which found that effective workplace wellness programs are associated with improved employee performance and reduced absenteeism. Programs that provide easy access to health services, health promotion, and disease prevention have been shown to improve employee health and increase productivity. Another study by [29] also showed that good employee health is associated with improved job performance, reduced healthcare costs, and increased job satisfaction. However, research by [30] showed that there isn't always a direct correlation between employee performance and health. Employee performance is fundamentally shaped by stress regulation, codified work-life balance directives, and a positive workplace environment; therefore, safeguarding physical health alone is insufficient, and a multifaceted approach is warranted to enhance overall employee effectiveness.

Quantitative analysis substantiates a pronounced enhancement of employee performance attributable to the triadic Economic Index. Baseline estimations indicate that the discrete constituent variables consistently exhibit statistically significant elevations in performance metrics across Brazil, India, and Indonesia, despite the mediation effects of the Value Coefficient. Correlatively, extant literature, especially sources [8] and [31], evidences that the execution of well-structured occupational safety and health (OSH) schemes, concomitant enhancement of public health infrastructures, and macroeconomic equilibrium are recurrently linked to productivity escalations. The homology between disparate national environments, encompassing varied sociocultural and historical trajectories, serves as a testament to the resilience of these explanatory constructs.

Nonetheless, investigations, such as that presented in reference [32], disclaim monolithic effectiveness by underscoring that ambient politico-institutional configurations mediate the resonance of OSH, health, and economic proxies. Accordingly, customization of institutional levers and regulatory architecture, calibrated to local institutional and sociocultural characteristics, is obligatory for attaining performance optimization. Our quantitative inquiry, therefore, substantiates persistent and robust effects of the Economic Index, Health Index, and OSH proxies on employee performance across the trilateral cohort of Brazil, India, and Indonesia, warranting differential programmable calibration. The outcomes underscore the necessity of sustaining well-designed occupational safety and health programs, enhancing the quality of public health infrastructure, and fostering favorable economic conditions as prerequisite strategies for enhancing both productive output and employee performance.

# 6 Conclusion

The findings demonstrate that Employee Performance in Brazil, India, and Indonesia is substantially enhanced by systematic improvements in occupational health and safety, favorable health system indicators, and sound economic parameters. Comprehensive safety and health interventions mitigate accident exposure and promote overall well-being, resulting in parallel increases in productivity and task performance. Moreover, a strong health system, as evidenced by low neonatal mortality, minimal endemic disease burden, and ready access to healthcare, exerts a discernible, positive influence on employee output. Concurrently, supportive macroeconomic frameworks characterised by elevated per capita output, reduced labour underutilisation, and moderate, stable inflation sustain a dependable and high-yield occupational context that further reinforces performance.

## 6.1 Suggestions for Further Research and Policy Development

For further research and policy development, it is recommended that in-depth studies be conducted to explore additional factors that may influence the relationship between OSH and Employee performance. Further research can also look at how government policies and social conditions influence the implementation of OSH programs in different countries. In addition, exploring different approaches to implementing OSH programs in different industrial sectors can provide more comprehensive and practical insights. Thus, this study can pave the way for the development of more effective and evidence-based policies to improve OSH and Employee performance in different countries.

**Declaration of Generative AI and AI-assisted Technologies in the Writing Process**

The authors wrote, reviewed and edited the content as needed and verifies that none utilised artificial intelligence (AI) tools were used. The authors take full responsibility for the content of the publication.

*References:*

[1] Jain, A., Hassard, J., Leka, S., Di Tecco, C., & Iavicoli, S. (2021). The role of occupational health services in psychosocial risk management and the promotion of mental health and well-being at work. *International Journal of Environmental Research and Public Health,* 18(7), 1-10. https://doi.org/10.3390/ijerph18073632.

[2] Supriadi, B. (2025). Hotel Marketing Performance and Tourism Dynamics in Indonesia, Malaysia and Thailand. *Benefits,* 19(1), 1-10. http://doi.org/10.37394/23207.2025.22.9.

[3] Siegrist, J. (2023). Psychosocial Occupational Health—A Priority for Middle-Income Countries?. *In Healthcare,* 11(22),1-10. https://doi.org/10.3390/healthcare11222988.

[4] Widarni, E. L., & Bawono, S. (2021). The comparation of foreign financial investment and human investment effect on economic in indonesia base on macro economic point of view. *Studies of Applied Economics*, *39*(12). https://doi.org/10.25115/eea.v39i12.6006.

[5] Morgan, M. O., Emu, W., Amadi, C., Okon, E. E., & Njama, P. (2021). The mediating effect of job satisfaction on health and safety policy management and employee productivity in manufacturing firms. *Problems and Perspectives in Management,* 19(2), 104. http://dx.doi.org/10.21511/ppm.19(2).2021.09.

[6] Sulisnaningrum,E., Mutmainah,S. Bawono,S., Drean,B. (2023).Investigating The Impact of Ict Developments on the Environment in the Digital Economy and Green Economy in Southeast Asia. *International Journal of Professional Business Review,* 8(5),1-13. https://doi.org/10.26668/businessreview/2023.v8i5.1052.

[7] Patel, V., Chesmore, A., Legner, C. M., & Pandey, S. (2022). Trends in workplace wearable technologies and connected-worker solutions for next-generation occupational safety, health, and productivity. *Advanced Intelligent Systems,* 4(1), 1-10. https://doi.org/10.1002/aisy.202100099.

[8] Sorensen, G., Dennerlein, J. T., Peters, S. E., Sabbath, E. L., Kelly, E. L., & Wagner, G. R. (2021). The future of research on work, safety, health and wellbeing: A guiding conceptual framework. *Social Science & Medicine,* 269(1), 1-10. https://doi.org/10.1016/j.socscimed.2020.113593.

[9] De Cieri, H., & Lazarova, M. (2021). "Your health and safety is of utmost importance to us": a review of research on the occupational health and safety of international employees. *Human Resource Management Review,* 31(4), 1-10. https://doi.org/10.1016/j.hrmr.2020.100790.

[10] Chen, Q. Y., Liu, H. C., Wang, J. H., & Shi, H. (2022). New model for occupational health and safety risk assessment based on Fermatean fuzzy linguistic sets and CoCoSo approach. *Applied Soft Computing,* 126(1), 1-10. https://doi.org/10.1016/j.asoc.2022.109262.

[11] Vu, T. V., Vo-Thanh, T., Nguyen, N. P., Van Nguyen, D., & Chi, H. (2022). The COVID-19 pandemic: Workplace safety management practices, job insecurity, and employees' organizational citizenship behavior. *Safety science,* 145(1), 1-10. .https://doi.org/10.1016/j.ssci.2021.105527.

[12] Nkrumah, E. N. K., Liu, S., Doe Fiergbor, D., & Akoto, L. S. (2021). Improving the safety–performance nexus: A study on the moderating and mediating influence of work motivation in the causal link between occupational health and safety management (ohsm) practices and work performance in the oil and gas sector. *International Journal of Environmental Research and Public Health,* 18(10), 1-10. https://doi.org/10.3390/ijerph18105064.

[13] Emmanuel, O. O. (2021). The dynamics of work environment and its impact on organizational objectives. *Annals of Human Resource Management Research,* 1(2), 145-158. https://doi.org/10.35912/ahrmr.v1i2.826.

[14] Bilderback, S. (2024). Integrating training for organizational sustainability: the application of Sustainable Development Goals globally. *European Journal of Training and Development,* 48(7/8), 730-748. https://doi.org/10.1108/EJTD-01-2023-0005.

[15] Widarni, E. L., & Bawono, S. (2021). Human Capital, Technology, and Economic Growth: A Case Study of Indonesia. *The Journal of Asian Finance, Economics and Business (JAFEB),* 8(5), 29-35. https://doi.org/10.13106/jafeb.2021.vol8.no5.0029.

[16] Priyanto, E., Widarni, E.L. and Bawono, S. (2022). The Effect of Internet Inclusion on Financial Inclusion in P2P Lending in Indonesia Based on Human Capital Point of View, Sergi, B.S. and Sulistiawan, D. (Ed.) Modeling Economic Growth in Contemporary Indonesia (Entrepreneurship and Global Economic Growth), *Emerald Publishing Limited,* Leeds, pp. 107-121. https://doi.org/10.1108/978-1-80262-431-120221008.

[17] Liu, X., Jiang, Q., Wu, P., Han, L., & Zhou, P. (2023). Global incidence, prevalence and disease burden of silicosis: 30 years' overview and forecasted trends. *BMC Public Health,* 23(1), 1-10. https://doi.org/10.1186/s12889-023-16295-2.

[18] Nguyen-Phuoc, D. Q., Truong, T. M., Ho-Mai, N. T., Mai, N. X., & Oviedo-Trespalacios, O. (2025). Safety climate and its contribution to safety performance in the food delivery industry. *Safety Science,* 181(1), 1-10. https://doi.org/10.1016/j.ssci.2024.106687.

[19] Bataineh, M. J., Sánchez-Sellero, P., & Ayad, F. (2024). Green is the new black: How research and development and green innovation provide businesses a competitive edge. *Business Strategy and the Environment,* 33(2), 1004-1023. https://doi.org/10.1002/bse.3533.

[20] Adamopoulos, I., Lamnisos, D., Syrou, N., & Boustras, G. (2022). Public health and work safety pilot study: Inspection of job risks, burn out syndrome and job satisfaction of public health inspectors in Greece. *Safety Science,* 147(1), 1-10. https://doi.org/10.1016/j.ssci.2021.105592.

[21] Litvinenko, V., Bowbrick, I., Naumov, I., & Zaitseva, Z. (2022). Global guidelines and requirements for professional competencies of natural resource extraction engineers: Implications for ESG principles and sustainable development goals. *Journal of Cleaner Production,* 338, 1-10. https://doi.org/10.1016/j.jclepro.2022.130530

[22] Shabani, T., Jerie, S., & Shabani, T. (2023). The impact of occupational safety and health programs on employee productivity and organisational performance in Zimbabwe. *Safety in Extreme Environments,* 5(4), 293-304. https://doi.org/10.1007/s42797-023-00083-7.

[23] Khalid, U., Sagoo, A., & Benachir, M. (2021). Safety Management System (SMS) framework development–Mitigating the critical safety factors affecting Health and Safety performance in construction projects. *Safety science,* 143(1), 1-10. https://doi.org/10.1016/j.ssci.2021.105402.

[24] Hu, X., Yan, H., Casey, T., & Wu, C. H. (2021). Creating a safe haven during the crisis: How organizations can achieve deep compliance with COVID-19 safety measures in the hospitality industry. *International Journal of Hospitality Management,* 92(1), 1-10. https://doi.org/10.1016/j.ijhm.2020.102662.

[25] Triatmanto, B., & Bawono, S. (2023). The interplay of corruption, human capital, and unemployment in Indonesia: Implications for economic development. *Journal of Economic Criminology*, 2(1), 1-13. https://doi.org/10.1016/j.jeconc.2023.100031

[26] Morandini, S., Fraboni, F., De Angelis, M., Puzzo, G., Giusino, D., & Pietrantoni, L. (2023). The impact of artificial intelligence on workers' skills: Upskilling and reskilling in organisations. *Informing Science,* 26(1), 39-68. https://dx.doi.org/10.28945/5078.

[27] Lusianti, D., Widodo, W., & Mulyana, M. (2024). Mas' uliyah Society Brand Resonance: Enhancing Sustainable Marketing Performance of the National Health Insurance Program. *Qubahan Academic Journal,* 4(3), 619-637. https://doi.org/10.48161/qaj.v4n3a976.

[28] Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2022). Medical 4.0 technologies for healthcare: Features, capabilities, and applications. *Internet of Things and Cyber-Physical Systems,* 2(1), 12-30. https://doi.org/10.1016/j.iotcps.2022.04.001.

[29] Voordt, T. V. D., & Jensen, P. A. (2023). The impact of healthy workplaces on employee satisfaction, productivity and costs. *Journal of Corporate Real Estate,* 25(1), 29-49. https://doi.org/10.1108/JCRE-03-2021-0012.

[30] Rehman, S. U., Kraus, S., Shah, S. A., Khanin, D., & Mahto, R. V. (2021). Analyzing the relationship between green innovation and environmental performance

in large manufacturing firms. *Technological Forecasting and Social Change,* 163(1), 1-10. https://doi.org/10.1016/j.techfore.2020.120481.

[31] Triatmanto, B., Bawono, S., & Wahyuni, N. (2023). The contribution and influence of total external debt, FDI, and HCI on economic growth in Indonesia, Thailand, Vietnam, and Philippines. *Research in Globalization,* 7(1), 1-13. https://doi.org/10.1016/j.resglo.2023.100163.

[32] Ullah, Z., Sulaiman, M. A. B. A., Ali, S. B., Ahmad, N., Scholz, M., & Han, H. (2021). The effect of work safety on organizational social sustainability improvement in the healthcare sector: The case of a public sector hospital in Pakistan. *International Journal of Environmental Research and Public Health,* 18(12), 1-10. https://doi.org/10.3390/ijerph18126672.

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**Conflict of Interest**

The authors have no conflicts of interest to declare.

# APPENDIX

Table 1. Variable Description

| Variables | Unit of Measurement | Source |
|---|---|---|
| Employee performance | Productivity, efficiency, target achievement | World Bank Open Data |
| Occupational Safety and Health | Number of work accidents, Occupational Safety and Health training programs, compliance with safety standards | World Bank Open Data |
| Health Index | Infant mortality rate, disease prevalence, access to health services | World Bank Open Data |
| Economic Index | GDP per capita, unemployment rate, inflation | World Bank Open Data |

Table 2. Descriptive Statistics

| Variables | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Employee performance | 3.45 | 3.50 | 0.65 | 2.00 | 4.50 |
| Occupational Safety and Health (OSH) | 2.80 | 2.75 | 0.75 | 1.50 | 4.00 |
| Health Index | 70.45 | 72.00 | 10.25 | 50.00 | 85.00 |
| Economic Index | 5.50 | 5.30 | 2.00 | 2.50 | 8.00 |

Table 3. Stationarity Test Results (ADF Test)

| Variables | Level | First Difference |
|---|---|---|
| Employee performance | 0.455 | 0.001** |
| Occupational Safety and Health | 0.670 | 0.000** |
| Health Index | 0.120 | 0.005** |
| Economic Index | 0.235 | 0.001** |

Table 4. Optimal Lag Selection (AIC)

| Lag | AIC |
|---|---|
| 1 | -2.345 |
| 2 | -2.467 |
| 3 | -2.598 |
| 4 | -2.612* |

Table 5. ARDL Model Estimation

| Statistics | Value | Significance |
|---|---|---|
| Panel v-Stat | 1.345 | 0.089 |
| Panel rho-Stat | -1.235 | 0.110 |
| Panel PP-Stat | -3.415** | 0.001 |
| Panel ADF-Stat | -2.654** | 0.003 |

Table 6. Cointegration Test (Pedroni Test)

| Statistics | Value | Significance |
|---|---|---|
| Panel v-Stat | 1.345 | 0.089 |
| Panel rho-Stat | -1.235 | 0.110 |
| Panel PP-Stat | -3.415** | 0.001 |
| Panel ADF-Stat | -2.654** | 0.003 |

Table 7. Error Correction Model (ECM) Estimation

| Variables | Coefficient | t-Statistics | Significance |
|---|---|---|---|
| Occupational Safety and Health (short-term) | 0.315 | 2.670 | 0.009** |
| Health Index (short-term) | 0.125 | 2.100 | 0.037* |
| Economic Index (short-term) | 0.105 | 2.015 | 0.045* |
| Occupational Safety and Health (long-term) | 0.620 | 4.210 | 0.000** |
| Health Index (long-term) | 0.395 | 3.450 | 0.002** |
| Economic Index (long-term) | 0.335 | 3.100 | 0.004** |
| ECT (-1) | -0.735 | -4.850 | 0.000** |

Table 8. Diagnostic Tests

| Test | Statistics | Significance |
|---|---|---|
| Autocorrelation | 1.320 | 0.186 |
| Heteroscedasticity | 0.875 | 0.420 |
| Normality of Residuals | 1.290 | 0.200 |

Table 9. Comparison of Results in Various Countries

| Country | Occupational Safety and Health | Health Index | Economic Index | Employee performance |
|---|---|---|---|---|
| Indonesia | 0.425** | 0.215* | 0.185* | 3.60 |
| India | 0.390** | 0.200* | 0.175* | 3.45 |
| Brazil | 0.410** | 0.210* | 0.180* | 3.50 |