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SDG Adoption, Health and Safety Policy Strength, and Injury Performance across Firms in the Energy Value Chain

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ABSTRACT: *This study examines the link between the adoption of Occupational Health and Safety (OHS)-related Sustainable Development Goals (SDGs), the strength of health and safety policy, and injury rates in the energy sector. It also evaluates whether these relationships differ among Upstream, Midstream, Downstream, and Crossstream firms to clarify how sustainability efforts connect to operational safety. A quantitative cross-sectional design was used, based on data from 281 energy firms drawn from Refinitiv Datastream. OHS-related SDG adoption was measured using SDG 3 and SDG 8 indicators; policy systems were assessed using a health and safety policy score; and performance was measured using the injury rate. Analyses included descriptive statistics, Pearson correlations, Kruskal–Wallis tests, and Ordinary Least Squares regression. The results show that greater SDG adoption and stronger health and safety policies are associated with lower injury rates. Policy scores vary significantly across energy value chain segments, but injury rates do not differ by segment. In the regression model, both SDG variables and health and safety policy scores continue to show a negative relationship with injury rates. Midstream firms report higher injury rates than Upstream firms. This research informs business management, sustainability reporting, ESG analysis, and OHS evaluation. The findings help managers, analysts, and policymakers assess whether sustainability commitments and formal policy systems align with measurable safety in high-risk sectors such as energy. This study advances research by integrating SDG commitment, formal health and safety policy systems, and injury rates within a single empirical framework. It compares these relationships across energy value chain segments, showing that sustainability alignment and policy strength are distinct yet complementary paths associated with better safety outcomes.*

Key words*: Energy value chain, injury rate, occupational health and safety (OHS), safety policy, SDG 3, SDG 8.*

1. Introduction

Occupational Health and Safety (OHS) remains a central issue in the energy sector because firms operate in environments marked by physical hazards, technical complexity, and strong regulatory and public scrutiny. In this context, safety performance is not only a matter of operational control. It is also an organizational outcome shaped by managerial commitment, formal systems, internal monitoring, and the extent to which firms translate stated priorities into everyday practice. At the same time, sustainability-related commitment has become increasingly visible in corporate reporting. Among the frameworks used to communicate such commitment, the Sustainable Development Goals (SDGs) have gained particular prominence. In relation to worker well-being, SDG 3, Good Health and Well-Being, and SDG 8, Decent Work and Economic Growth, are especially relevant because they connect the sustainability discourse to employee health, safe working conditions, and decent employment. At the corporate level, adoption of these goals may indicate that worker-related concerns are incorporated into the organization's broader sustainability agenda.

However, the growing visibility of SDG language in corporate reporting raises an important question. The literature repeatedly shows that SDG-related disclosure does not automatically reflect substantive organizational change. Firms often refer to the SDGs in broad, selective, or symbolic ways, without clearly linking them to strategic objectives, internal systems, measurable targets, or key performance indicators

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(Silva, 2021; Van Der Waal & Thijssens, 2020; Heras-Saizarbitoria et al., 2022; Lodhia et al., 2023). Even firms regarded as sustainability leaders may exhibit weak operational integration of the SDGs, posing a risk of symbolic alignment rather than genuine implementation (Ferrero-Ferrero et al., 2023). This makes it necessary to test whether worker-related SDG adoption is actually associated with a concrete safety outcome, such as injury performance.

A second issue concerns the role of formal policy systems. If SDG adoption reflects alignment with an external sustainability framework, the health and safety policy addresses something more internal: the formalization of expectations, responsibilities, rules, and procedures for worker protection. Prior studies suggest that organizational systems and governance structures matter for sustainability-related implementation and performance. Management control systems, board-level arrangements, and institutional pressures can shape whether sustainability commitments are translated into organizational practice (Nishitani et al., 2021; García-Sánchez et al., 2022; Toukabri & Youssef, 2023). Yet formal policy strength should not be assumed to guarantee better outcomes. A firm may disclose a strong policy while still facing implementation gaps, weak enforcement, or uneven operational execution. This suggests that SDG adoption and health and safety policy may represent distinct yet complementary pathways to worker safety.

These issues are especially relevant in the energy sector because it is internally heterogeneous. Upstream, Midstream, Downstream, and Crossstream firms occupy different positions in the value chain and therefore face different technological conditions, infrastructures, risk exposures, and reporting pressures. Research on SDG disclosure and sustainability practices indicates that sector and activity type matter for how firms prioritize, communicate, and implement sustainability commitments (Bonfanti et al., 2023; Gutiérrez-Ponce, 2023; Lenort et al., 2023; Manes-Rossi & Nicolo, 2022). A value chain perspective is therefore useful because it allows analysis to move beyond the assumption that the energy sector is uniform and instead examine whether differences across segments are more visible in organizational systems and commitments than in injury outcomes themselves.

Against this background, the present study examines whether the adoption of SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth), and the strength of health and safety policy, are associated with injury performance across the energy value chain. Using a sample of 281 energy firms, the study links adoption-level indicators and a system-level indicator to an outcome-level measure, namely the total injury rate. In doing so, it moves beyond broad discussions of sustainability reporting and SDG communication. It asks a more specific question: whether worker-related sustainability commitment is associated with worker-related performance.

The study contributes in three ways. First, it connects sustainability-oriented adoption measures to a concrete operational outcome. Second, it distinguishes between public sustainability alignment and internal formal policy systems rather than treating them as interchangeable indicators of commitment. Third, it examines these relationships across value chain segments within the energy sector, thereby recognizing the industry's internal heterogeneity. The remainder of the paper is structured as follows. Section 2 reviews the relevant literature and develops the hypotheses. Section 3 describes the research design, variables, data source, and analytical strategy. Section 4 presents the empirical findings. Finally, Section 5 concludes the paper by discussing the main implications, limitations, and directions for future research.

2. Literature Review

2.1. Occupational Health and Safety as an Organizational Outcome

Occupational Health and Safety (OHS) is now often defined as an organizational capability rather than just a compliance task. In high-risk industries, injury rates depend on management's commitment, system quality, leadership focus, monitoring practices, and workplace culture. This broader view is highly relevant in the energy sector, where worker safety influences not only employees but also regulators, investors, communities, and a company's legitimacy. Key studies show a strong link between OHS and sustainable development—particularly via SDG 3 and SDG 8 (Reis et al., 2020; Kavouras et al., 2022; Milea et al., 2025).

Research supports that safety should be understood as an outcome shaped by organizational factors. The main claim is that strong management controls, responsiveness to stakeholder expectations, and top-level commitment support better sustainability efforts, including OHS. Nishitani et al. (2021) argue that strong systems enhance accountability and consistency, a logic that also applies to safety. Lopes Santos et al. (2019) highlight that accident rates are linked to organizational structures. Additionally, Pourmazaherian and

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Musonda (2022), Feng et al. (2025), and Hutauruk and Ekawati (2025) identify competence, safety orientation, and leadership attitudes as critical predictors. Taken together, these studies emphasize that safety should be built into organizations rather than treated as a technical add-on.

Health and safety policy serves as a system-level indicator of formal managerial commitment, reflecting how organizations codify expectations, responsibilities, and rules for worker protection. However, robust policy disclosure does not automatically translate into improved performance. Organizations may disclose formal policies yet still encounter implementation gaps or inconsistent operational practices. Consequently, it is necessary to empirically assess whether stronger formal policy systems are associated with lower injury rates.

2.2. SDG Adoption and Commitment to Worker Well-Being

The SDGs have become central reference points in corporate sustainability communication. Organizations utilize them to signal social responsibility, construct strategic narratives, and align activities with global priorities. Regarding worker well-being, SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth) are particularly significant, as they address health, working conditions, and employment. Recent review-based and conceptual studies confirm that OHS is closely linked to these goals and that the relationship is mutually reinforcing: enhanced safety practices can contribute to SDG progress, while SDG-based frameworks can also strengthen safety approaches within organizations (Lim et al., 2025; Milea et al., 2025; Reis et al., 2020).

At the organizational level, adopting these goals may indicate that worker-related issues are being incorporated into the sustainability agenda. However, existing literature shows that SDG language in reporting often fails to reflect true commitments within systems or performance structures. Silva (2021) and Van Der Waal and Thijssens (2020) observe that organizations reference the SDGs primarily in broad, symbolic terms, with little detail on targets and comprehensive disclosures. Heras-Saizarbitoria et al. (2022) and Lodhia et al. (2023) find that engagement is frequently superficial, with few firms linking SDGs to strategic objectives or key performance indicators. Fonseca and Carvalho (2019) add that even organizations with certified quality, environmental, and OHS systems provide only moderate SDG reporting.

The reviewed literature suggests that adopting the SDGs, by itself, does not necessarily indicate a true commitment to worker welfare. Instead, mentioning SDG 3 and SDG 8 may mostly signal external alignment with worker well-being values. Whether this alignment results in actual improvements in safety performance remains an open empirical question.

2.3. Symbolic Versus Substantive SDG Engagement

A central debate in the literature is whether SDG disclosure represents a genuine commitment or is mainly a symbolic act. Many studies argue that companies use SDG references to boost legitimacy without truly integrating them into strategy, governance, or internal processes. This distinction matters for research linking communication about sustainability to operational outcomes.

Many studies support this view. Heras-Saizarbitoria et al. (2022) describe broad "SDG-washing" and little real change. Manes-Rossi and Nicolo (2022) find the same in the European energy sector: disclosure grew but remained symbolic. Nicolò et al. (2023) show that integrated reports can mix symbolic and real SDG paths. Ferrero-Ferrero et al. (2023) note that even sustainability leaders do not always use the SDGs as targets or KPIs. Calabrese et al. (2021) and Costa et al. (2025) note that broad SDG disclosure does not mean deep monitoring or long-term goals. Böhling, Murguía, and Godfrid (2019) add that reporting can be performative and not lead to better practice.

Studies on OHS yield similar findings. Lim et al. (2025) observe increasing acknowledgment of the relationship between safety and the SDGs, yet integration is inconsistent. Ebekozien et al. (2025) demonstrate that, despite recognizing the importance of safety management for SDG 3 and SDG 8, performance may remain suboptimal in the presence of barriers. Overall, public SDG adoption should not be assumed to improve organizational performance directly.

2.4. Internal Systems, Governance, and Implementation

A second strand of research highlights that substantive sustainability outcomes depend not only on external alignment but also on internal systems, governance structures, and implementation mechanisms. This

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perspective suggests that organizations differ not only in their communications but also in the extent to which sustainability is embedded within managerial controls, procedures, and decision-making processes. Nishitani et al. (2021) demonstrate that both SDG alignment and management control systems contribute to stronger outcomes. García-Sánchez, Aibar-Guzmán, Aibar-Guzmán, and Somohano-Rodríguez (2022) find that institutional pressures, organizational incentives, and board-level characteristics influence the integration of the SDGs into non-financial reporting systems. Toukabri and Youssef (2023) similarly show that governance characteristics positively affect carbon disclosure and related performance, while Santos and Bastos (2021) demonstrate that SDGs can be integrated at normative, operational, and strategic levels depending on organizational motivations.

Safety-focused studies yield comparable conclusions, indicating that effective implementation relies on a combination of formal structures, managerial support, and behavior. These findings reinforce the distinction between public sustainability alignment and formal internal systems: while SDG adoption indicates alignment with external frameworks, health and safety policy formalizes internal rules and responsibilities. An organization may perform well in one area but not the other, making this distinction central to the current study, as multiple organizational pathways may influence worker safety performance.

2.5. Sectoral and Value Chain Heterogeneity

The literature demonstrates that sustainability reporting and implementation vary across sectors, industries, and operational contexts. Bonfanti et al. (2023), Gutiérrez-Ponce (2023), and Lenort et al. (2023) each find that SDG engagement differs significantly across sectors and value-creation contexts. Van der Waal, Thijssens, and Maas (2021) similarly report that SDG-related innovation patterns vary by industry. In the energy sector, Manes-Rossi and Nicolo (2022) observe that SDG disclosure is increasing, yet the prevailing pattern remains largely symbolic. Recent evidence from the oil and gas sector further highlights the importance of operational realities. Salleh et al. (2024) demonstrate that SDG 3, SDG 8, and SDG 16 are integrated into Occupational Safety and Health culture through HSE policies, safety campaigns, regulatory enforcement, and incentives. Hutauruk and Ekawati (2025) also show that safety performance in oil and gas is influenced by training effectiveness, management support, and individual learning-related factors.

A broader strategic perspective emphasizes the importance of activity type and value chain position. Van Zanten and Van Tulder (2021a) demonstrate that economic activities vary considerably in their positive and negative impacts on the SDGs, while Van Zanten and Van Tulder (2021b) advocate for a nexus perspective that recognizes trade-offs and interdependencies. Supply chain and collaborative network studies similarly indicate that sustainability performance is influenced by an organization's position within broader operational systems and by coordination with other actors (Agrawal et al., 2022; Ramanathan et al., 2025; Sadic et al., 2024). This is especially pertinent to the energy value chain, where Upstream, Midstream, Downstream, and Crossstream firms encounter distinct infrastructures, risk profiles, technologies, and organizational requirements. These variations may influence how organizations formalize health and safety systems, adopt worker-related SDGs, and report injury outcomes.

2.6. Research Gap and Hypotheses

The existing literature offers important insights into SDG disclosure, symbolic versus substantive engagement, internal systems, governance structures, and sectoral differences. However, most studies emphasize disclosure quality, legitimacy, institutional drivers, or broad sustainability performance. Considerably less attention has been devoted to examining whether worker-related SDG adoption is associated with specific operational outcomes such as injury performance. Even fewer studies integrate worker-related SDG adoption, the strength of formal health and safety policy, and injury outcomes within a single empirical framework. This gap persists even in recent OHS literature. While recent studies confirm that OHS is closely linked to SDG 3 and SDG 8 (Lim et al., 2025; Milea et al., 2025), others demonstrate that safety performance is influenced by competence, leadership, training effectiveness, and management support (Pourmazaherian & Musonda, 2022; Feng et al., 2025; Hutauruk & Ekawati, 2025). However, these strands are seldom integrated into firm-level empirical models, particularly in the energy sector and across value chain segments.

This study addresses this gap by integrating three levels of analysis. First, it assesses adoption-level commitment through SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic

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Growth). Second, it evaluates system-level commitment through the strength of the health and safety policy. Third, it measures outcome-level performance using a company's injury rate. Additionally, the study adopts a value chain perspective to examine whether these indicators vary across Upstream, Midstream, Downstream, and Crossstream firms.

Based on this framework, the following hypotheses are proposed:

H_1: Firms with higher OHS-related SDG adoption report lower injury rates.

H_2: Firms with stronger health and safety policy scores report lower injury rates.

H_3: OHS-related SDG adoption and health and safety policy strength differ across energy value chain segments.

H_4: Injury rates differ across energy value chain segments.

The findings help clarify whether SDG adoption and formal health and safety systems reflect separate organizational pathways associated with lower injury rates.

3. Methodology

3.1. Research Design

This study adopts a quantitative cross-sectional design to examine whether worker-related SDG adoption and formal health and safety systems are associated with injury performance in the energy sector. The analysis is based on a sample of 281 energy firms observed in 2024 and classified into four value chain segments: Upstream, Midstream, Downstream, and Crossstream. All firm-level data were obtained from Refinitiv Datastream, which was selected for its standardized ESG, policy, and performance indicators, enabling comparable analysis across firms.

The empirical framework distinguishes between adoption-level indicators, system-level indicators, and an outcome-level indicator. More specifically, the study examines whether the adoption of SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth), and the strength of health and safety policy, are associated with lower injury rates. This structure makes it possible to assess whether public sustainability alignment and formal internal policy systems represent distinct but complementary organizational pathways linked to worker safety performance.

The energy sector provides an appropriate empirical setting because it combines high-risk operating conditions with substantial heterogeneity across value chain activities. This allows the analysis to assess not only firm-level associations among the main variables, but also whether these variables differ systematically across segments of the energy value chain.

3.2. Variables and Measurement

This study uses three main groups of variables: adoption-level indicators, a system-level indicator, and an outcome-level indicator.

The first group captures the adoption of OHS-related SDGs. Two binary variables are used: SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth). Each variable indicates whether the firm is identified as adopting the respective SDG in its sustainability-related profile. The second key explanatory variable is health and safety policy strength, which captures the degree to which worker-safety-related organizational systems are formally established. This variable is measured using the health and safety policy score available in Refinitiv Datastream. In the present study, this score is treated as a system-level indicator that reflects the formalization of internal commitments, rules, and procedures related to worker protection.

The dependent variable is the total injury rate, which serves as the study's outcome-level indicator of safety performance. Because the distribution showed high skewness and kurtosis, the variable was winsorized at the 5th and 95th percentiles to reduce the influence of extreme observations and improve the stability of the analysis. The adjusted injury-rate variable was used in all empirical tests.

The model also includes firm-size and value chain-segment dummies as control variables. Firm size is included to account for the possibility that larger firms may differ from smaller firms in their sustainability adoption, policy formalization, and reporting structures. Value chain position is captured using categorical variables that identify firms as Upstream, Midstream, Downstream, or Crossstream. In the regression analysis, Upstream is used as the reference category, while Midstream, Downstream, and Crossstream are entered as comparison groups.

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3.3. Analytical strategy

The empirical analysis proceeds in four stages. First, descriptive statistics are used to summarize the distribution of SDG adoption, health and safety policy strength, and injury performance across the sample. Second, Pearson correlation coefficients are estimated to assess the direction and strength of bivariate associations among the main variables. Third, Kruskal–Wallis tests are conducted to examine whether SDG adoption, health and safety policy strength, and injury rate differ across the four energy value chain segments. A nonparametric approach is appropriate here because it allows comparison of group distributions without relying on strict normality assumptions.

Fourth, Ordinary Least Squares (OLS) regression is used to estimate the association of SDG adoption and health and safety policy strength with injury performance, while controlling for firm size and energy value chain segment. This step allows assessment of whether the main relationships remain statistically detectable after including relevant controls. All statistical analyses were conducted using IBM SPSS Statistics, version 21.

Taken together, this analytical strategy moves from description to bivariate association to nonparametric group comparison and finally to multivariate estimation. It is appropriate for evaluating whether worker-related SDG adoption and formal policy strength are associated with injury performance, and whether value chain differences are more visible in organizational commitments than in outcome-level safety indicators.

4. Results

4.1. Descriptive Statistics

Table 1 presents the descriptive statistics for the main study variables. The injury-rate variable reported in the analysis reflects the winsorized measure described in the methodology. The results indicate partial adoption of the two worker-related SDG indicators across the sample. SDG 3, Good Health and Well-Being, is adopted by 47.0% of firms, while SDG 8, Decent Work and Economic Growth, is adopted by 54.8%. The injury rate has a mean of 1.96 and a standard deviation of 1.74, showing meaningful variation across firms. By contrast, the health and safety policy score is tightly distributed, with a mean of 51.35 and a standard deviation of 0.49, suggesting limited dispersion in the formal policy measure. Overall, the descriptive results suggest that the sample exhibits moderate worker-related SDG adoption, relatively compressed policy scores, and broader variation in injury performance.

Table 1. Descriptive statistics of the study variables.

Variable	N	Minimum	Maximum	Mean	Standard Deviation
SDG 3, Good Health and Well-Being	281	0.00	1.00	0.470	0.500
SDG 8, Decent Work and Economic Growth	281	0.00	1.00	0.548	0.499
Injury rate	281	0.05	5.76	1.959	1.737
Health and Safety Policy score	281	50.89	51.94	51.351	0.488

Note: SDG 3 and SDG 8 are binary indicators coded 1 if the firm adopts the respective SDG and 0 otherwise. The injury-rate variable was winsorized at the 5th and 95th percentiles.

4.2. Correlation Analysis

Table 2 reports the Pearson correlations among the main variables. The results show that the injury rate is negatively associated with each key explanatory variable. The correlation between injury rate and health and safety policy score is −0.310 and statistically significant at the 0.01 level. Injury rate is also negatively associated with SDG 3 adoption ($r = -0.282$, $p < .001$) and SDG 8 adoption ($r = -0.272$, $p < .001$). These findings indicate that firms with stronger formal health and safety policy scores and firms adopting worker-related SDGs tend to report lower injury rates.

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Table 2. Pearson correlations among the main variables.

Variable	1	2	3	4	5
1. Injury rate	1.000				
2. Health and Safety Policy score	-0.310**	1.000			
3. SDG 3	-0.282**	-0.027	1.000		
4. SDG 8	-0.272**	-0.036	0.597**	1.000	
5. Firm size	-0.094	-0.028	0.039	0.069	1.000

Note: $p < .01$ for coefficients marked with **. The results indicate that the injury rate is negatively associated with both SDG indicators and Health and Safety Policy score. In contrast, the policy score is not significantly correlated with SDG 3 or SDG 8.

At the same time, the association between the health and safety policy score and the two SDG indicators is weak and not statistically significant. The correlation between policy and SDG 3 is −0.027, while the correlation between policy and SDG 8 is −0.036. By contrast, SDG 3 and SDG 8 are positively and significantly associated ($r = 0.597$, $p < .001$), indicating that the two adoption indicators tend to co-occur. Taken together, these results suggest that worker-related SDG adoption and formal policy strength are linked to the same outcome, but they reflect different organizational dimensions.

4.3. Kruskal–Wallis Value Chain Comparisons

Table 3 presents the results of the Kruskal–Wallis tests across the four energy value chain segments. The results show that the health and safety policy score differs significantly across the energy value chain. The test statistic is $\chi^2 = 48.285$ with $p < .001$, indicating clear cross-segment variation. The mean-rank results show that Crossstream firms have the highest policy rank (178.28), followed by Midstream (164.33), while Downstream has the lowest rank (105.45). Upstream firms occupy an intermediate position (114.67). These findings suggest that value chain position is strongly associated with differences in the strength of formal policies.

Table 3. Kruskal–Wallis tests by energy value chain segment.

Variable	Upstream Mean Rank	Midstream Mean Rank	Downstream Mean Rank	Crossstream Mean Rank	Chi-square	df	p-value
Health and Safety Policy score	114.67	164.33	105.45	178.28	48.285	3	< .001
SDG 3	133.96	134.79	154.74	147.73	3.689	3	.297
SDG 8	129.23	138.73	155.14	151.61	6.665	3	.083
Injury rate	149.00	151.62	136.41	126.59	4.686	3	.196

Note: The grouping variable is the energy value chain segment. Only the Health and Safety Policy score differs significantly across segments.

By contrast, the value chain differences for the other variables are weaker. SDG 3 does not differ significantly across segments ($\chi^2 = 3.689$, $p = .297$), and SDG 8 also fails to reach conventional significance levels ($\chi^2 = 6.665$, $p = .083$). Similarly, the injury rate does not show statistically significant differences across the four segments ($\chi^2 = 4.686$, $p = .196$). Overall, these results indicate that segment position is more strongly reflected in formal health and safety policy than in broad differences in reported injury outcomes.

4.4. Multivariate Regression Results

Table 4 reports the OLS regression estimates for the injury rate. The model explains a meaningful share of the variation in injury performance. The multiple correlation coefficient is $R = .474$, indicating a moderate overall association between the observed injury rates and the model-predicted values. The coefficient of determination is $R^2 = .225$, while the adjusted R^2 is .205, which suggests that the included predictors account for roughly one-fifth of the variance in the dependent variable after adjustment for model complexity. The overall F statistic is 11.276 ($p < .001$), indicating that the model is statistically significant.

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Table 4. Ordinary Least Squares regression results

Predictor	B	Standard Error	Standardized Beta	t	p-value	VIF
Constant	71.242	11.240	—	6.338	< .001	—
SDG 3 adoption	-0.616	0.233	-0.177	-2.644	.009	1.577
SDG 8 adoption	-0.618	0.235	-0.177	-2.624	.009	1.601
Health and Safety Policy score	-1.321	0.219	-0.371	-6.033	< .001	1.326
Firm size	-0.050	0.029	-0.093	-1.724	.086	1.010
Midstream dummy	0.738	0.286	0.159	2.580	.010	1.335
Downstream dummy	-0.019	0.296	-0.004	-0.063	.950	1.175
Crossstream dummy	0.190	0.249	0.050	0.763	.446	1.537

Model statistics. $R = .474$; $R^2 = .225$; Adjusted $R^2 = .205$; $F = 11.276$, $p < .001$; Durbin–Watson = 1.895. Reference category. Upstream. Dependent variable. Injury rate.

The additional model diagnostics are also acceptable. The Durbin–Watson statistic is 1.895, which is close to 2 and therefore does not indicate a serious autocorrelation problem. Although serial correlation is less central in a cross-sectional setting than in time-series analysis, this result is still reassuring. The variance inflation factors range from 1.010 to 1.601, well below conventional threshold levels, indicating that multicollinearity is not a major concern. Overall, the model statistics support the adequacy and stability of the estimated specification.

The coefficient estimates show that both SDG indicators are negatively associated with injury performance. The coefficient for SDG 3 adoption is −0.616 ($p = .009$), and the coefficient for SDG 8 adoption is −0.618 ($p = .009$). The health and safety policy score also shows a strong negative association with the injury rate, with a coefficient of −1.321 ($p < .001$). These results indicate that firms adopting worker-related SDGs and firms with stronger formal health and safety policy scores tend to report lower injury rates, even after controls are included.

Regarding the control variables, firm size has a negative coefficient (−0.050) but is not statistically significant at the 5% level ($p = .086$). Among the value chain dummies, only the Midstream dummy is statistically significant, with a positive coefficient of 0.738 ($p = .010$), indicating higher injury rates relative to the Upstream reference category. The coefficients for the Downstream dummy ($p = .950$) and the Crossstream dummy ($p = .446$) are not statistically significant. Taken together, the regression results support the view that worker-related SDG adoption and the strength of formal health and safety policies are both associated with lower injury rates. At the same time, value chain differences are more selective and emerge primarily for Midstream firms.

5. Conclusion

This study investigated whether the adoption of SDG 3 and SDG 8, and the strength of health and safety policy, are associated with injury performance across the energy value chain in a sample of 281 energy firms. Both worker-related SDG adoption and higher health and safety policy scores are negatively associated with injury rates, supporting H1 and H2. Value chain analysis yields partial support for H3 and no support for H4: Health and safety policy varies significantly across value chain segments, but injury rates do not differ significantly. These findings clarify the relationship between specific SDG actions and injury outcomes.

This study advances the literature in three key ways. First, it moves beyond the prevailing focus on SDG disclosure quality and symbolic reporting. Research shows that firms often use SDGs language selectively or broadly, with limited integration and often without clear links to targets, implementation mechanisms, or measurable outcomes (Silva, 2021; Van Der Waal & Thijssens, 2020; Heras-Saizarbitoria et al., 2022; Lodhia et al., 2023). These findings are significant because they show that, for worker well-being and safety, adopting SDG 3 and SDG 8 is associated with tangible operational outcomes rather than just disclosure practices. While this does not prove that worker-related SDG adoption is always substantive, it suggests such adoption may be relevant to safety performance.

This is especially relevant because recent OHS studies link worker safety to SDG 3 and SDG 8 but mostly focus on concepts, safety culture, training, and barriers, rather than firm-level injury outcomes (Lim et al., 2025; Milea et al., 2025; Salleh et al., 2024). The present study shows that worker-related SDG adoption is not only conceptually relevant but also statistically associated with lower injury rates in the energy sector. Thus,

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the findings support examining OHS within a sustainability framework rather than merely engaging in symbolic reporting.

Second, this study clarifies the distinction between external sustainability alignment and internal formal systems. The results show that both SDG indicators and health and safety policy scores are negatively associated with injury performance, but not significantly correlated with each other. Thus, firms with stronger worker-related SDG adoption do not necessarily achieve higher health and safety policy scores, though both are associated with lower injury rates. This finding underscores that these variables are not interchangeable commitments but capture distinct dimensions of organizational practice.

This interpretation aligns with the broader literature. Calabrese et al. (2021), Costa et al. (2025), and Ferrero-Ferrero et al. (2023) show that broad SDG coverage does not ensure deep commitment, internal monitoring, or integration. Fonseca and Carvalho (2019) show that organizations with certified quality, environmental, and OHS systems do not always communicate extensively about the SDGs. Nishitani et al. (2021) show that formal systems and management controls can also improve sustainability outcomes independently of symbolic alignment. This study supports this by showing that worker-related SDG adoption and health and safety policy strength each influence outcomes, but through different means.

This distinction is further supported by recent safety-focused research. Feng et al. (2025) demonstrate that frontline leaders' safety attitudes influence workers' risk-taking behavior through risk perception, while Hutauruk and Ekawati (2025) find that management support, self-efficacy, training plans, and motivation to learn enhance training effectiveness and are associated with lower accident rates in the oil and gas sector. Pourmazaherian and Musonda (2022) also show that competence and safety orientation affect safety performance. Collectively, these studies and the present findings indicate that stronger safety outcomes result from a combination of visible commitment, internal formalization, managerial support, and behavioral processes, rather than a single mechanism.

Third, the study uses a value chain perspective to explain segment-level differences in formal systems. Significant variation in health and safety policy across Upstream, Midstream, Downstream, and Crossstream firms suggests that segment position shapes the formalization of safety systems. This finding aligns with research showing sector and activity type influence how firms prioritize, communicate, and implement the SDGs (Bonfanti et al., 2023; Gutiérrez-Ponce, 2023; Lenort et al., 2023). It also aligns with evidence from the energy sector that sectoral conditions shape SDG disclosures and are often more symbolic than substantive (Manes-Rossi & Nicolo, 2022). Here, the key insight is not just that segments differ, but also where these differences arise.

The results indicate that value chain heterogeneity is more evident in organizational systems than in broad comparisons of injury rates. This is theoretically significant, as it suggests that segment position may influence how firms structure policies, controls, and formal commitments more than it affects reported outcome measures in simple rank comparisons. This pattern is logical in a sector as diverse as energy, where firms vary in infrastructure, technologies, hazard profiles, operating environments, and reporting practices. In this context, injury rates may be shaped by multiple overlapping factors, while formal policy systems more directly reflect organizational choices and governance priorities.

Additionally, the regression results provide a more nuanced perspective. While nonparametric tests do not reveal significant differences in injury rates across value chain segments, the multivariate model shows that Midstream firms report higher injury rates than Upstream firms after controlling for relevant factors. This indicates that segment effects may become more apparent when adoption-level indicators, policy strength, and firm characteristics are considered together. Thus, broad rank comparisons may obscure heterogeneity that is more clearly revealed through multivariate analysis. This finding is particularly valuable as it cautions against interpreting the absence of simple group differences as evidence of uniformity across the energy value chain.

From a managerial perspective, the findings indicate that firms should not rely solely on public sustainability alignment or policy disclosure. While worker-related SDG adoption is relevant, a formal health and safety policy is particularly important as a system-level mechanism associated with lower injury rates. For managers, this suggests that stronger safety performance is more likely when visible sustainability commitment is combined with internal formalization, implementation, and follow-through. For ESG analysts and other stakeholders, the results highlight the need to evaluate worker well-being in the energy sector by considering both adoption signals and formal policy frameworks, rather than relying solely on sustainability language.

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These findings also contribute to a broader debate in the sustainability literature, which is often framed as a contrast between symbolic and substantive commitment. The present results indicate that, at least in relation to worker safety, this dichotomy may be overly simplistic. Worker-related SDG adoption can serve as a meaningful organizational signal, even if it is not closely correlated with formal policy scores. Simultaneously, formal policy systems remain independently significant. The practical implication is that organizations may achieve stronger safety performance through multiple pathways, but the most effective approach likely involves reinforcing external sustainability alignment with internal formal systems.

Several limitations should be considered when interpreting these findings. First, the cross-sectional design using 2024 data allows for the identification of associations but does not establish causality. Second, limited variation in the health and safety policy score across firms may constrain the ability to detect nuanced differences in the robustness of formal safety systems. Third, measurement of worker-related SDG adoption is restricted to SDG 3 and SDG 8, which, while central to worker well-being, do not encompass the full spectrum of governance and implementation practices that could affect injury outcomes. Fourth, reliance on reported injury rates as the dependent variable introduces potential bias due to variability in disclosure quality and reporting practices. Finally, the model incorporates a limited set of control variables, so unobserved firm-level and institutional factors may also influence the observed relationships.

Building on these limitations, future research could extend this study in several directions. Employing longitudinal designs would enable examination of whether changes in worker-related SDG adoption and policy strength precede changes in injury performance over time. Incorporating additional governance and implementation variables, such as safety management systems, board-level oversight, or assurance practices, may further elucidate the mechanisms by which adoption-level commitment translates into operational outcomes. Examining these relationships across diverse institutional contexts and refining the value chain perspective by introducing more granular operational categories within the energy sector would also be valuable. These extensions could clarify the interactions among sustainability commitment, formal systems, and safety performance under varying organizational and regulatory conditions.

In summary, this study shows that adopting SDG 3 and SDG 8, and implementing a stronger health and safety policy, are each associated with lower injury rates across the energy value chain. The findings emphasize that value chain position shapes formal safety systems more than reported injury rates. Together, the results support a nuanced perspective: both a commitment to sustainability and strong formal systems matter for improved safety performance. Ultimately, the study bridges SDG reporting and OHS, highlighting that sustainability commitments can yield operational results.

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