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Assessment of sector-specific human rights and environmental risks

Study Summary

Background

Global value chains have become increasingly complex, spanning multiple countries, suppliers, and production stages. While this has improved efficiency, it has also increased exposure to social and environmental risks, particularly in upstream supply chain tiers where transparency is limited (Seuring and Müller, 2008, p. 1699; Klassen and Vereecke, 2012, p. 103; Kähkönen et al., 2023, p. 9). As a result, companies face growing challenges in identifying and managing sustainability risks beyond their direct suppliers. With the Corporate Sustainability Due Diligence Directive (CSDDD), this challenge becomes a regulatory requirement. Companies are now obliged to conduct abstract risk analyses across their entire chain of activities, covering both country- and sector-specific risks (European Commission, n.d.; Art. 5–11 CSDDD). While country-level risk data is widely available, sector-specific risks are currently fragmented across academic studies, grey literature, and corporate reports, and lack a consistent structure. This makes systematic and comparable risk identification across sectors difficult in practice.

To address this gap, structured sector risk registers are required. Within the Catena-X initiative, a data ecosystem for supply chains in the automotive industry, such a risk register is currently being developed to support companies in implementing CSDDD requirements. A key prerequisite for this is the systematic identification and structuring of sector-specific sustainability risks. This study contributes to this objective by providing the foundational step by identifying and systematizing environmental and social risks across sectors based on academic and grey literature. The guiding research question is: *Which environmental and social risks derived from the legal categories defined by the CSDDD can be identified across sectors in academic and grey literature?* It thus addresses the critical first step of the risk management process – risk identification – enabling more structured and effective downstream risk assessment and prioritization.

Method

Methodologically, the study applies a systematic scoping review combined with qualitative content analysis (Arksey and O'Malley, 2005; Mayring, 2014). This approach enables the structured mapping of a heterogeneous body of literature and the development of a consistent risk classification. Sectors are categorized using the NACE classification system at the division level, ensuring comparability and applicability in a European regulatory context. Identified risks are aligned with the legal categories defined in the CSDDD. To enable systematic analysis, the risks

outlined in the directive are consolidated into 16 categories, following Bauder's (2026) proposal for categorization:

- R01: Right to Life, Physical and Mental Integrity, Liberty and Security
- R02: Right to Privacy, Family, Home, Correspondence, Honor and Reputation
- R03: Right to Freedom of Thought, Conscience and Religion
- R04: Right to Just and Favorable Conditions of Work
- R05: Rights of Children and Prohibition of Child Labour
- R06: Prohibiton of Forced Labour and Slavery
- R07: Right to Freedom of Association (Trade Unions), Right to Freedom of Assembly, Right to Organize, Strike and Collective Bargaining
- R08: Prohibition of unequal treatment in employment
- R09: Right of individuals, groupings and communities to lands, resources and subsistence
- R10: Other human rights violations
- R11: Prohibition of measurable environmental degradation with harmful effects on human rights
- R12: Prohibition of Deforestation
- R13: Obligation to Avoid or Minimise Adverse Impacts on Biological Diversity
- R14: Prohibition of Hazardous Substances, Activities and Waste
- R15: Prohibition of Substances Depleting the Ozone Layer
- R16: Obligation to Prevent Marine Pollution

The scoping review includes three main data sources: academic literature, grey literature, and company reports. Academic sources were identified through the Web of Science database, while grey literature was collected through a structured Google search. In addition, reports published under the German Supply Chain Due Diligence Act (LkSG) were analysed to incorporate practice-based insights. For the search process, predefined search strings were applied to ensure consistency and reproducibility.

One notable outcome of the Google search was the identification of the CSR Risk Check, a tool that provides detailed risk information for 471 products. Due to the breadth and depth of this dataset, it was treated as a distinct source in the subsequent analysis. To identify relevant companies subject to reporting requirements, the CSDDD Datahub provided by SOMO (Centre for Research on Multinational Corporations) was used as a sampling frame. As illustrated in Figure 1, the initial screening covered 547 academic studies, the first 100 Google search results, and 1,224 companies.

After applying inclusion and relevance criteria, the final sample consisted of 32 academic studies, six Google sources (including the CSR Risk Check, which contributed 471 additional documents), and 85 LkSG reports. All selected documents were analyzed using a structured coding framework developed based on qualitative content analysis following Mayring (2014). Relevant text passages containing sector-specific sustainability risks were systematically coded and assigned to one of the 16 CSDDD risk categories and one of 87 NACE sectors. In total, 1,305 individual risks were identified across 60 different sectors. This structured dataset forms the basis for subsequent analysis and provides a comprehensive foundation for building sector-specific risk registers.

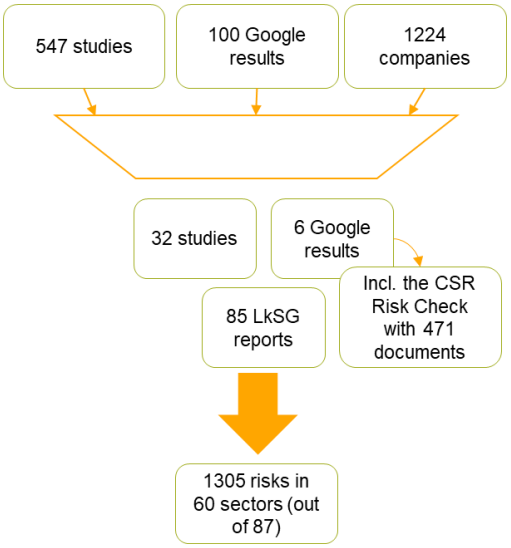


FIGURE 1 METHOD: USED SOURCES & DOCUMENTS

Results

The following section analyzes the results, noting that frequency reflects documented evidence rather than absolute risk levels. Of the 1,305 identified risks, approximately 70% are associated with the producing sector. In this study, this includes Agriculture, Mining, Manufacturing, Electricity, Water & Waste, and Construction. A further 17% of risks relate to Transport & Logistics, while 13% are attributed to Service and Administrative sectors (see figure 2). Of the 26 sectors in which no risks were identified, all but one belong to non-producing sectors, predominantly within administrative activities.

At the NACE division level, the five most frequently identified sectors are:

- *Crop and animal production, hunting (A01):* 133 mentions
- *Mining of metal ores (B07):* 99 mentions
- *Land transport (H49):* 75 mentions

- *Manufacture of motor vehicles and parts (C29):* 69 mentions
- *Electricity supply (D35):* 62 mentions

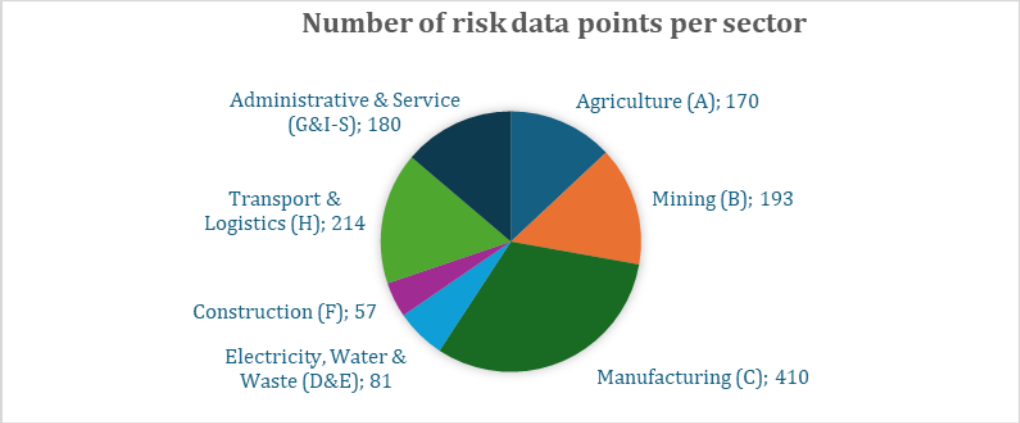


FIGURE 2 NUMBER OF RISK DATA POINTS PER SECTOR

With the exception of *Land transport (H49)*, which belongs to Transport & Logistics, all of these sectors are part of the producing sector. This further shows the clear concentration of documented sustainability risks in production-related activities.

Across all sectors, two risk categories stand out due to their high frequency. As illustrated in Figure 3, the category *Right to Just and Favorable Conditions of Work (R04)* is consistently among the most frequently identified risks. Similarly, *Prohibition of Measurable Environmental Degradation with Harmful Effects on Human Rights (R11)* shows a high number of mentions, particularly in producing sectors.

In addition, several risks exhibit strong sector-specific patterns:

- *Biodiversity impacts (R13)* are primarily identified in Agriculture (A) and Mining (B)
- *Land rights (R09)* are mainly associated with Mining (B)
- *Freedom of association (R07)* occurs predominantly in Manufacturing (C) and Transport & Logistics (H)
- *Child labor (R05)* is concentrated in Agriculture (A), Mining (B), and Manufacturing (C)

In contrast, some risk categories are only marginally represented, such as *Right to Privacy (R02)* and *Ozone Layer Depletion (R15)*. Overall, the results show a stronger focus on human rights risks compared to environmental risks.

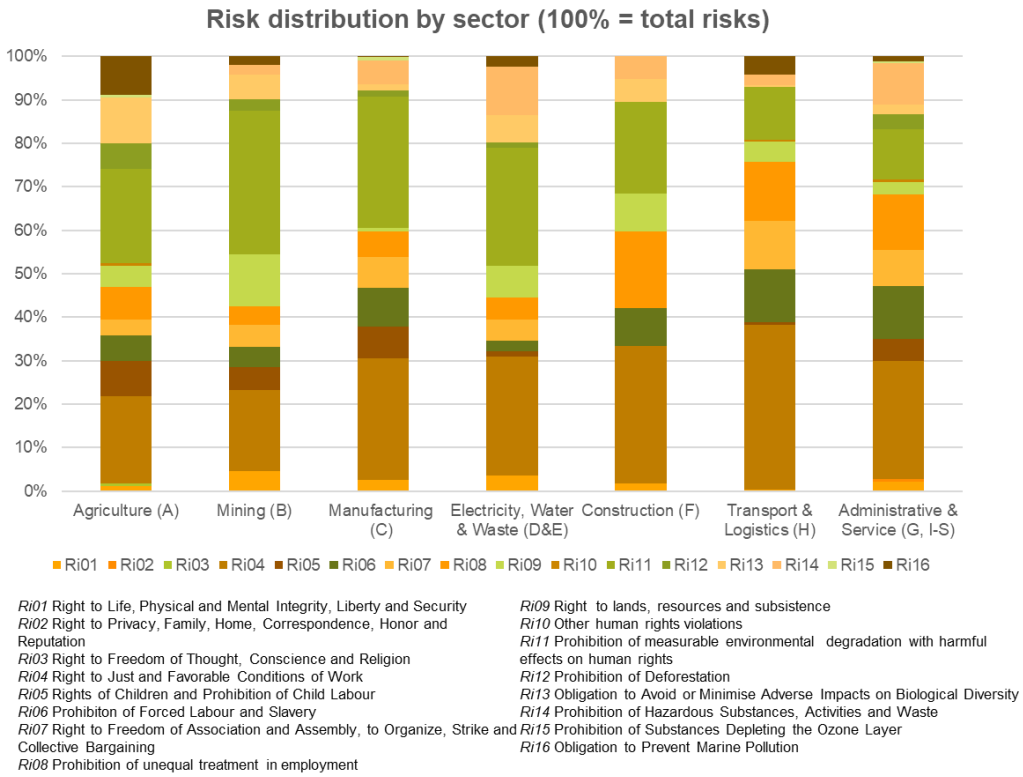
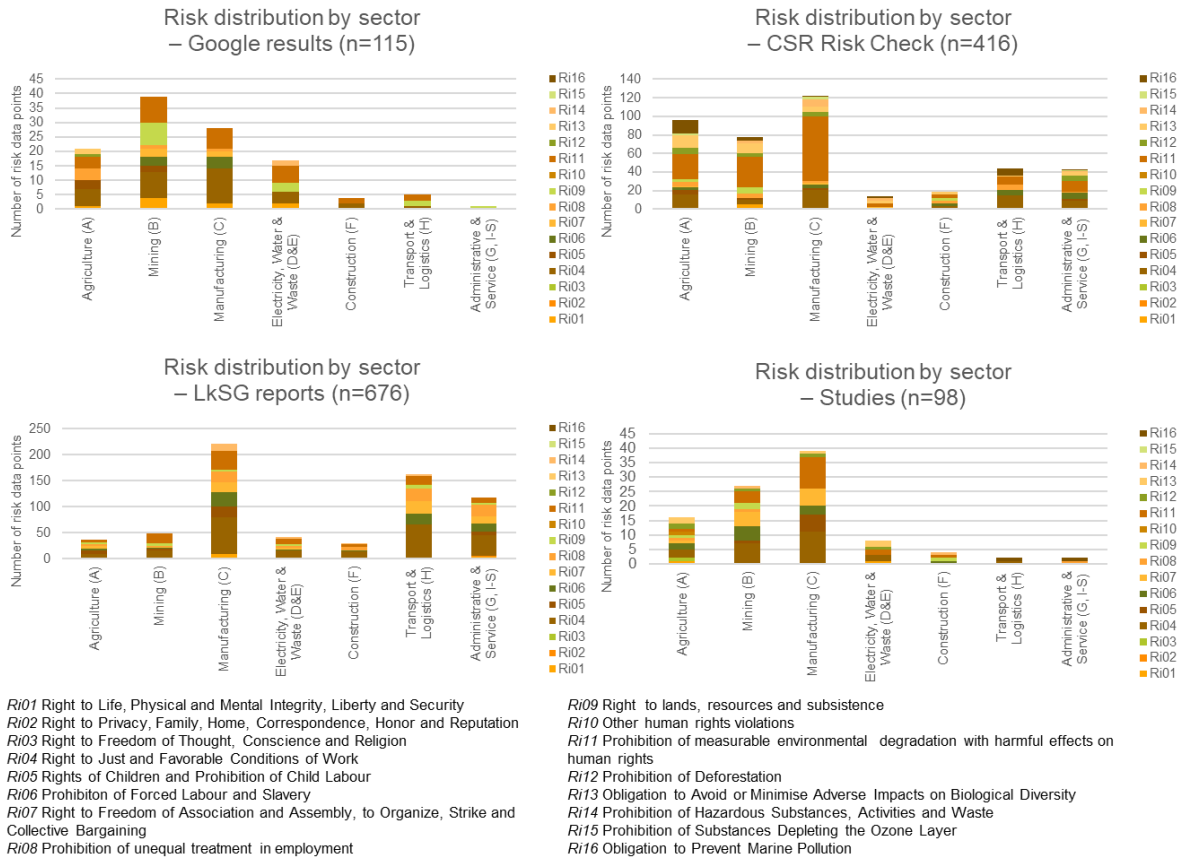


FIGURE 3 RISK DISTRIBUTION BY SECTOR

The analysis also reveals significant differences depending on the type of source used. Academic studies, the CSR Risk Check, and Google-based sources primarily focus on upstream risks, particularly in Agriculture (A) and Mining (B). In contrast, LkSG reports tend to emphasize downstream risks, especially in Transport & Logistics (H) as well as Service and administrative sectors (G, I–S). All source types show a general focus on Manufacturing (C) (see figure 4). However, at the division level, clear differences emerge. For example, the sector *Manufacture of motor vehicles and parts (C29)* is the most frequently identified sector in LkSG reports but does not appear in the other source types. Conversely, the sector *Manufacture of leather and related products (C15)* is among the most prominent in the CSR Risk Check but is not reflected in the remaining sources. These differences can be partly explained by the composition of the data. Automotive companies represent the largest group within the analyzed LkSG reports and therefore primarily report risks within their own operations and direct supply chains. Notably, none of the analyzed LkSG reports originate from companies in Agriculture or Mining. It is assumed that for most reporting companies Agriculture and Mining are indirect suppliers. Supporting this assumption, companies predominantly report risks related to direct suppliers.

A comparison of risk profiles across source types further highlights differences in emphasis. The CSR Risk Check places a particularly strong focus on *Prohibition of Measurable Environmental Degradation with Harmful Effects on Human Rights (R11)* compared to other sources. In addition, it identifies *Marine Pollution (R16)* 30 times across sectors, whereas this risk appears only twice in academic studies and is not identified in the other source types.

These findings highlight that the identification and prioritization of sustainability risks are strongly influenced by the perspective and scope of the underlying data sources, which has important implications for the design and interpretation of risk registers.



Ri01 Right to Life, Physical and Mental Integrity, Liberty and Security
Ri02 Right to Privacy, Family, Home, Correspondence, Honor and Reputation
Ri03 Right to Freedom of Thought, Conscience and Religion
Ri04 Right to Just and Favorable Conditions of Work
Ri05 Rights of Children and Prohibition of Child Labour
Ri06 Prohibiton of Forced Labour and Slavery
Ri07 Right to Freedom of Association and Assembly, to Organize, Strike and Collective Bargaining
Ri08 Prohibition of unequal treatment in employment
Ri09 Right to lands, resources and subsistence
Ri10 Other human rights violations
Ri11 Prohibition of measurable environmental degradation with harmful effects on human rights
Ri12 Prohibition of Deforestation
Ri13 Obligation to Avoid or Minimise Adverse Impacts on Biological Diversity
Ri14 Prohibition of Hazardous Substances, Activities and Waste
Ri15 Prohibition of Substances Depleting the Ozone Layer
Ri16 Obligation to Prevent Marine Pollution

FIGURE 4 RISK DISTRIBUTION BY SECTOR AND SOURCE

Discussion, Limitations and Outlook

This study set out to systematically identify and structure sector-specific human rights and environmental risks in line with the CSDDD. By combining a scoping review with qualitative content analysis, 1,305 risk instances across 60 sectors were identified and assigned to 16 CSDDD-based risk categories. The results provide a first structured and regulatory-aligned overview of

sector-specific sustainability risks and address a previously existing gap in both research and practice.

A key finding is the strong concentration of documented risks in producing sectors and Transport & Logistics. In particular, upstream sectors such as Agriculture (A) and Mining (B) are frequently associated with sustainability risks. However, this should not be interpreted as evidence of higher absolute risk levels. Rather, it reflects a higher degree of visibility and documentation in both academic and practice-oriented sources. For example, Mining is widely studied due to its environmental and human rights risks, as well as its high public visibility in the context of conflicts and environmental incidents (Franken and Schütte, 2022, pp. 653–654; Mancini and Sala, 2018, p. 99). Similarly, Agriculture is strongly represented due to its link to biodiversity loss and increasing attention to labor conditions (Finance for Biodiversity Foundation, n.d., p. 1; Orou Sannou, Kirschke and Günther, 2023, p. 175).

The analysis also reveals systematic differences between source types. While academic and grey literature focus more on upstream risks, LkSG reports emphasize downstream risks and direct suppliers. This highlights that risk visibility is strongly influenced by perspective, data availability, and reporting incentives. More broadly, the findings suggest that risk identification based on a single data source would lead to incomplete and potentially biased results.

Another important observation is the uneven coverage of sectors. Nearly all sectors without identified risks belong to non-producing, administrative, or service-oriented activities. This does not imply the absence of risks but rather reflects limited data availability and a structural bias in both research and practice toward production-related sectors. This is consistent with broader management literature, where many analytical frameworks originate from industrial contexts and are less developed for service-based sectors (Chernov and Sornette, 2020, p. 5).

Across all sectors, social risks are identified more frequently than environmental risks. At the same time, certain categories, particularly *Right to Just and Favorable Conditions of Work (R04)* and *Environmental degradation with human rights impacts (R11)*, are especially prominent. This is likely due to their higher measurability and strong integration into existing governance frameworks. It indicates that frequency is influenced not only by actual risk exposure but also by the availability of indicators, auditability, and institutionalization.

Despite these contributions, several limitations need to be considered. The qualitative coding process involves interpretative decisions, which may affect consistency. The literature search,

while broad, does not guarantee full coverage of all relevant sources. The sample of LkSG reports is also constrained by data availability and sectoral biases. In addition, methodological decisions, such as assigning risks to sectors in cases of missing information, may influence the observed distributions. Furthermore, the study focuses on the identification and structuring of risks rather than their assessment. The frequency of risk mentions should therefore not be interpreted as a proxy for likelihood or severity.

Building on these findings, several practical implications for the development of sector risk registers can be derived. First, sector risks should not be based on a single dataset, as different sources capture different parts of the value chain and risk landscape. Instead, combining multiple data sources is essential to ensure a more comprehensive and balanced risk identification. Second, the level of sector aggregation should be adapted to data availability: sectors with limited data should be clustered at a higher NACE level, while sectors with a large number of observations should be analyzed with greater granularity using more detailed NACE classifications. Third, a similar principle applies to risk categories. Highly represented risks, such as working conditions (R04), should be further differentiated into more specific sub-categories, including working hours, occupational health and safety, and adequate wages, in order to improve their practical usability. Fourth, the results highlight the need for an additional step of risk quantification. The frequency of risk mentions reflects visibility rather than probability and therefore needs to be complemented by further assessment dimensions such as likelihood and severity. Finally, existing evidence gaps, particularly in underrepresented sectors, should be addressed through complementary approaches such as expert validation or targeted data collection.

Overall, the study provides a structured and practical foundation for building sector-specific risk registers under the CSDDD. It demonstrates that robust risk identification requires combining multiple data sources, adapting sector granularity, refining risk categories where needed, and complementing qualitative insights with quantitative assessment approaches.

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