

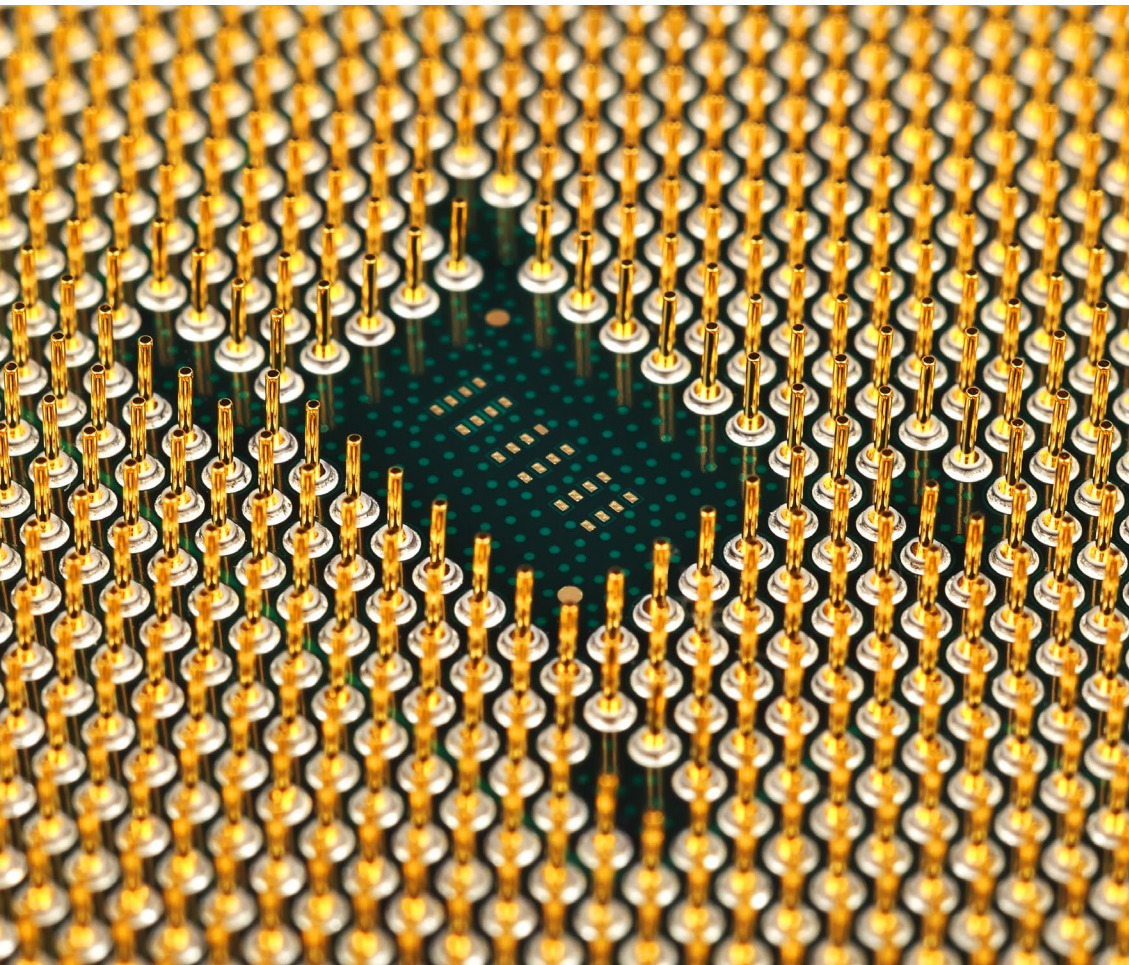
ESG Materiality Map

Technology Hardware And Semiconductors

Oct. 19, 2022

Environmental factors, such as climate transition risk and physical climate risk, and waste and recycling, are the most material for the sector, although currently more so for stakeholders than credit. Among material social factors, working conditions is material to stakeholders with limited credit materiality to date.

This report does not constitute a rating action



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In line with the research report “[Materiality Mapping: Providing Insights Into The Relative Materiality Of ESG Factors](#),” published on May 18, 2022, S&P Global Ratings is publishing research on the ESG materiality map for the technology hardware and semiconductors sector. We provide an illustration of our current view of the relative materiality of certain environmental and social (E&S) factors, from both the stakeholder and credit perspectives, for the sector. The materiality map does not represent any new analytical approach to the treatment of E&S factors in our credit ratings. See our ESG criteria for more information on how we incorporate the impact of ESG credit factors into our credit ratings analysis.

Technology Hardware And Semiconductors Sector

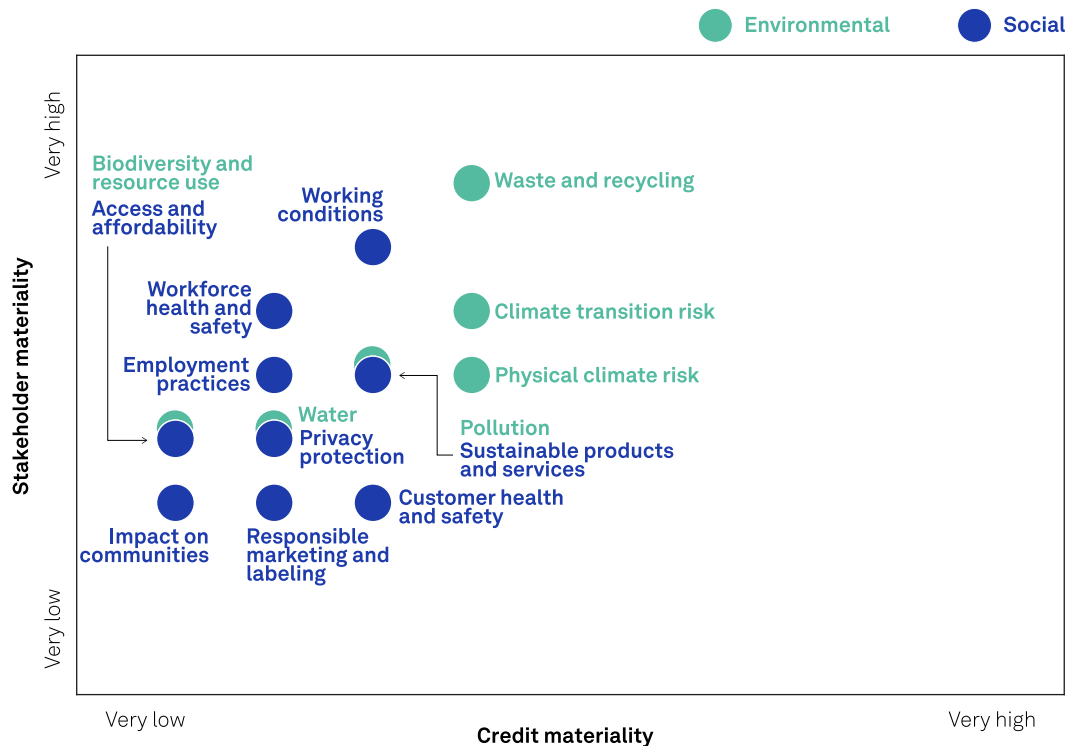
The tech hardware and semiconductor sector includes computer hardware, storage and peripherals, electronic components, electronic manufacturing services, communications equipment and technology distributors, as well as semiconductor equipment, chip design, and fabrication companies. The industry’s value chain extends from semiconductor fabrication to end products sold by original equipment manufacturers (OEMs).

Key Takeaways

- The hardware and semiconductor sector faces environmental issues that are more material for stakeholders than credit, with primary exposures to end-of-life disposal and an increasing focus on the recycling and reuse of equipment and components.
- Climate transition and physical climate risk, as well as waste and recycling, are material to stakeholders, and to a lesser extent, credit. Hardware and semiconductor manufacturing is energy intensive, involving heavy metals and toxic chemicals. Physical climate events can damage manufacturing facilities and disrupt operations. These exposures have had limited impact on credit but risks to the sector are rising.
- Working conditions are material to stakeholders but it has had limited impact on credit to date. We believe tech companies have vested interests in their supply chain’s strict code of conduct as their brand values could be impaired by any violations.

See materiality map on the following page.

ESG Materiality Map For The Technology Hardware And Semiconductors Sector



The materiality map provides an illustration at a point in time, of our findings on the relative materiality of certain environmental and social (E&S) factors, from both the stakeholder and credit perspectives, for the sector. It does not represent any new analytical approach to the treatment of E&S factors in our credit ratings. See our ESG Criteria for more information on how we incorporate the impact of ESG credit factors into our credit ratings analysis. Source: S&P Global Ratings.

How To Read The ESG Materiality Map

The stakeholder materiality (Y axis) reflects our assessment of the relative level of impacts and dependencies of the sector on the environment, society, and economy.

The credit materiality (X axis) reflects our assessment of the relative level of potential and actual credit impact for the sector. The credit implications for the factors positioned on the left side to the middle of the X-axis would be more limited and absorbable. On the right side, there is higher potential for these implications to be more disruptive. We assess credit implications for an entity based on its individual characteristics.

Assessing E&S factors' materiality: We consider both the likelihood of the impact from a given factor, as well as the magnitude of the impact. The materiality of the factors varies depending on the perspective (stakeholder or credit) as well as the evolving and dynamic interactions between these two dimensions.

The main areas of the map:

- The upper-right quadrant displays the most material, on a relative basis, E&S factors identified for the sector from both a stakeholder and credit perspective.
- The upper-left quadrant presents factors that are more material from a stakeholder than credit perspective. These factors have the potential to become more material from a credit perspective.
- The bottom-left quadrant shows factors that are less material for both stakeholders and credit. Their materiality may evolve over time and this dynamic may not be linear.

Examples Of Material Factors

Below we provide the rationale of some of the material factors to illustrate the above findings.

Waste and recycling

Waste generation in manufacturing and supply chain activities, including product end-of-life is the most material issue to stakeholders and to a lesser degree for credit. Product lifecycle management and electronic waste specifically can have a significant environmental impact. A large portion of waste disposal and other hazardous waste concerns occur in the supply chain when improper waste management can affect local communities and ecosystems. In addition, the high replacement rate for electronic equipment fueled by innovation and fashion trends has created an ever-growing challenge related to end-of-life disposal. Material impacts are low thus far from the credit perspective. We believe there could be more industry-wide standards, or even regulatory intervention, in the future such as mandatory take-back policies or right-to-repair, that could result in higher costs and additional supply chain complexities. However, we believe tech companies are prepared for these potential concerns such that credit materiality remains low. We anticipate these companies will continue designing robust product lifecycle management programs, such as recycling and reuse of electronic equipment, that can facilitate the recovery of precious and rare earth metals for use in next generation hardware, which can help reduce future waste generation and potentially lower input costs.

Climate transition risk

Climate transition risk is material to stakeholders and slightly less material to credit. Through the stakeholder lens materiality is driven by energy-intensive product manufacturing that contributes to climate change through direct and indirect greenhouse gas emissions. Globally, the sector (including usage of products), is thought to contribute around 2% to 3% of GHG emissions. However, hardware companies are often more conscious about energy conservation and climate transition than other industries as their suppliers and end customers may base their purchasing decision on tech products' energy efficiency and the tech companies' carbon emission goals. Major tech hardware companies have aggressive targets to transition to green power but the level of implementation varies. Semiconductor production also involves the use of PFCs, HFCs, and other gases with high global warming potentials, which may become more regulated in the future, and require further R&D and investment to abate. From the credit perspective, tech hardware companies are most likely to experience some universal measures, such as carbon taxes, directly or indirectly, which would have direct or indirect impacts on operating costs and could have sector-specific restrictions imposed. Thus far these measures have not had any material credit impact on companies in the sector. If introduced, they could increase the credit materiality for hardware and semiconductor companies that have fewer financial resources and are less prepared for this transition.

Working conditions

Working conditions is material to stakeholders, particularly given the sector's highly labor-intensive supply chains, with limited credit materiality. Issues related to labor rights, wages, working hours, poor working conditions, and labor unrest at manufacturers and suppliers, particularly in facilities in Asia-Pacific, may affect many stakeholders and sometimes severely. Farther up the supply chain, there are issues linked to poor working conditions, including forced and child labor in sourcing rare earths and minerals, which are critical inputs to the sector. From a credit perspective, we believe many tech companies have historically mitigated these risks by

working closely with their suppliers to ensure codes of conduct are applied throughout their extensive supply chains. Nevertheless, working conditions issues are persistent in the sector and looking forward, entities may be expected to invest more heavily in supply chain tracking and traceability systems and well as more rigorous social risk monitoring and remediation, particularly in light of evolving regulation (including, for instance, proposed EU supply chain human rights due diligence legislation).

Physical climate risk

We view semiconductor and to a lesser degree, hardware companies' exposure to physical climate risk to be moderate from both a credit and stakeholder perspective. Acute physical risks--like storms and flooding--have caused widespread damage to people, manufacturing facilities, and cascading supply chain disruption in many regions. At the same time, chronic risks--that is, long-term changes in temperature and precipitation patterns, including water stress and drought--absent adaptation, will likely disrupt the sector and stakeholders widely. From a credit perspective there will be increasing costs to semiconductor manufacturers who are significant water users. As many manufacturing operations are primarily outsourced to Asia-Pacific, the risks associated with business interruptions from climate hazards are magnified in the hardware and semiconductor global supply. The downtime and interruption to operations, and higher maintenance and raw material--particularly water--costs, could affect profitability. However, this will vary between regions and in areas that are more likely to be vulnerable to climate risks in the future, some operators may need to invest in adaptation measures to provide increased operational resilience.

Pollution

Pollution is moderately material to both stakeholders and credit. Wastewater and solid waste including plastics and electronic waste generated in hardware manufacturing can contain heavy metals and toxic chemicals leading to water and land pollution affecting local ecosystems. Upstream mineral extraction as an input to hardware (e.g. rare earth metals) also have adverse environmental impacts. While wastewater is an issue limited to manufacturing sites, improper disposal of products at end-of-life could result in chemicals and plastic leaching into the environment, adversely affecting local ecosystems. The moderate credit materiality is driven by potentially higher operating costs and capital expenditures to deal with hazardous waste and poor management of waste disposal that can put companies at a higher risk of regulatory fines or reputational harm.

What is our approach to research on the ESG materiality map?

Referring to the research report “[Materiality Mapping: Providing Insights Into The Relative Materiality Of ESG Factors](#),” published on May 18, 2022, this research is built on the ESG materiality concept that considers ESG issues as material when they could affect stakeholders, potentially leading to material direct or indirect credit impact on entities. It considers that all businesses, through their activities and interactions, impact and depend, directly or indirectly, on stakeholders such as the environment (natural capital), society (human and social capital), and economy (financial capital). Using this ESG materiality concept, S&P Global Ratings has worked toward identifying a common, global, cross-sector set of E&S factors that we believe are material to stakeholders, and either are already, or have the potential to become, credit material for entities. The materiality map we propose provides an illustration at a point in time, of our findings on the relative materiality of those factors, from both the stakeholder and credit perspectives.

How does the sector ESG materiality map relate to credit ratings or ESG evaluations?

The sector materiality map is a visual representation of the factors that we consider impactful to the sector from a stakeholder and credit perspective for the purposes of this research. It does not represent any new analytical approach to the E&S factors in our credit ratings.

The relative materiality of the factors indicated on the materiality maps may inform the E&S Risk Atlas scores and the weights of the E&S factors used in ESG evaluations.

They may also inform our discussions with issuers on those factors’ existing or potential credit materiality.

Related Research

- [Materiality Mapping: Providing Insights Into The Relative Materiality Of ESG Factors](#), May 18, 2022
- [Environmental, Social, And Governance Principles In Credit Ratings](#), Oct. 10, 2021
- [ESG Evaluation Analytical Approach](#), Dec. 15, 2020

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