

Comment

Six research priorities to support corporate due-diligence policies

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Laws to stamp out deforestation, pollution and child labour in global supply chains might have unintended consequences. Researchers need to investigate these effects.

A chocolate bar bought in the United States might have been made in Belgium with cocoa from Côte d'Ivoire, almonds from Morocco, vanilla from Madagascar and sugar from Brazil. It is hard to know, however, whether these ingredients were grown on deforested land or harvested using forced or child labour. It's the same story for smartphones, clothes and cosmetics. Sourcing and manufacturing their components might have contaminated rivers, exposed workers to toxins or caused biodiversity loss.

That's why, in February, the European Commission proposed a directive on corporate due diligence for sustainability. It sets out how companies operating in the European Union with more than 250 employees would be required to identify, prevent, mitigate and stop any negative impacts on the environment and on human rights embedded in their supply chains. Otherwise, they would face sanctions, fines and lawsuits.

Other countries and organizations are discussing similar proposals, including the Organisation for Economic Co-operation and Development. To be effective, such efforts must be consistent and well-reasoned. Policy frameworks are needed to extend and harmonize due diligence, and research is needed to support it.

Such measures are necessary because existing policies are too limited in scope. For example, California's Transparency in Supply Chains Act of 2010 and the 2018 Australian Modern



An illegal gold mine in Ghana.

Slavery Act require large companies to report their efforts to eliminate modern slavery and human trafficking from their supply chains. Around 18 million people are subjected to forced labour in global supply chains, from workers in agriculture and mining to manufacturing and construction. France's 2017 law on corporate duty of vigilance, which covers environmental infractions as well as human rights, has opened up legal routes for third parties to sue companies for damages caused by their subsidiaries, suppliers or subcontractors. But there have been few lawsuits so far. The first was filed in 2019 by six civil-society organizations against the oil giant Total, regarding the impacts of an oil project in a national park in Uganda, and is ongoing.

Voluntary pledges by companies to free

their supply chains from unethical practices have been ineffective¹. Ambitious announcements are rarely matched by actions. For instance, some companies have committed to sourcing beef, palm oil, soya and cocoa that causes little or no deforestation. However, one analysis found that few of these firms monitored the progress of indirect suppliers or worked with local smallholders to improve farming practices². Instead, many companies pursue the easiest and cheapest routes, such as ceasing to use suppliers that perform poorly.

The evidence on these voluntary commitments says little about what shifts might happen under stricter mandatory measures. Policymakers need such insight.

Here, we outline the main challenges to performing due diligence on corporate

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sustainability and predicting its effects, with a focus on the mining and agriculture sectors. We set out six research priorities to build the knowledge needed to develop effective policy.

Interlinked unknowns

Roughly one-third of the gross domestic product of lower-income economies comes from agriculture and mining, each of which brings a slew of human-rights and environmental issues (see 'Unsustainable supply chains').

Worldwide, around 29% of people in modern slavery (5.4 million) and some 70% of all child labourers (about 100 million) work in agriculture, mostly in lower-income countries^{3,4}. Around 51% of the global forest lost between 2001 and 2015 went to agriculture, mainly for cropland and pastures^{5,6}. This loss of habitat poses extinction risks to 49% of all species classified as critically endangered by the International Union for Conservation of Nature.

In the mining sector, five of the six most biodiversity-rich biomes⁷ – from Australia to Ghana and Peru – provide around 79% of the metal ore extracted globally. This threatens thousands of species. Artisanal mining of cobalt, tin, gold and tungsten is often associated with pollution, hazardous working conditions and child labour^{4,7–9}. For example, more than half of the world's cobalt production comes from mines in the Katanga Copperbelt region of the Democratic Republic of the Congo (DRC), where about 20% is extracted by artisanal miners under hazardous working conditions⁹. Cobalt is toxic, and people living near such mines have been found to have high levels of the metal in their urine and blood⁹.

Supply chains extending from these industries are complex, making due diligence difficult to enforce. Even proactive companies struggle to determine the origin of their products beyond direct suppliers. For example, the technology giant Apple contracts dozens of manufacturers to produce computer chips and batteries and to assemble its smartphones and computers. Its 2021 list of minerals suppliers comprises 291 refineries and smelters in 41 countries that provide cobalt, lithium, tin, tantalum, tungsten and gold (see go.nature.com/3xt4zty). Current regulatory efforts around the supply of minerals in general are limited to ensuring that sourcing from other countries does not directly finance armed groups (see, for example, go.nature.com/3zvijfr). All of these materials end up in many sectors, for example in vehicles and construction.

It is even harder to predict the knock-on effects of mandating due diligence. Tighter standards in one region don't necessarily translate into better conditions elsewhere. Although stricter rules for major importers in the United States and EU could persuade some of the companies they buy from to raise their standards, that's not guaranteed. Some US or EU companies might simply

stop using suppliers in least-developed and conflict-affected countries such as the DRC, where there is also illegal mining of gold and coltan (niobium and tantalum ore). And there could be unintended consequences. Children who used to work in illicit gold mines might become child soldiers instead, for example.

Six priorities

Because the effects of mandatory supply-chain requirements can differ greatly from those of voluntary guidance, researchers urgently need to plug the following knowledge gaps.

Assess impacts. It is crucial to anticipate the socio-economic and environmental impacts of policies before they are rolled out. But there has been little analysis of how the effects of sustainability policies propagate from local to global scales and back¹⁰. Modelling tools have limitations. For example, computable general equilibrium (CGE) models, which simulate how an economy reacts to shocks or new technologies or policies, work only on data that are aggregated by nation or sector. This makes it difficult to assess, for instance, how policies in one nation affect households or ecosystems in other regions. Modelling and forecasting strategies are needed that work across scales.

Detailed data to inform these models are also scant. Regular household surveys, such as the World Bank's Living Standards and Measurement Surveys, are not available for all countries. Enterprise surveys that gather business information on a representative group of one

"Tighter standards in one region don't necessarily translate into better conditions elsewhere."

economy's private companies are even rarer. Both could help to predict the impacts of policies on different socio-economic groups or businesses. Targeted investments are needed to fill these data gaps.

One overlooked source of information is empirical studies of implemented policies, such as those that quantify drivers of deforestation. Better use must be made of such studies – they aren't currently incorporated into CGE models because the research communities are separate. For example, models that include empirical estimates of the extent to which changes in agricultural land are sensitive to economic and policy shocks would enable researchers to simulate the effect of policies on converting biodiverse natural forests to farmland. This would avoid underestimating losses of ecosystem services and would provide more detail.

Measure compliance. Researchers need to assess monitoring and examine the trade-offs

between data validity, reliability and costs. If companies cannot prove that due-diligence requirements are being met along their supply chains, consumers have no reason to believe that the products were produced sustainably, and will not pay a higher price for them. Similarly, if instances of non-compliance such as human-rights violations become public, companies face reputational risks.

Digital and technological approaches can help. Remote sensing and satellite imagery can track deforestation effectively, for instance¹¹. Coca Cola is testing blockchain technology that would underlie a secure registry of workers to reduce forced labour in Brazil. Yet many of these approaches are still in the pilot stage. It is unclear whether they are scalable or feasible in contexts such as smallholder farms, for example. And concerns over data privacy and surveillance need to be addressed for those who are subject to auditing.

Who does the monitoring matters. Third-party auditing by independent companies – such as the Dutch firm Control Union in Rotterdam, Bureau Veritas in Neuilly-sur-Seine, France, and FLOCERT in Bonn, Germany – is costly. Auditors are usually hired by the certified company or farmers' organization. Most audits are announced in advance and, for group certification – the norm in the smallholder sector – inspectors are able to visit only a small subset of suppliers. Allowing companies to monitor and report on their own supply chains is subjective and hard to verify, and lacks public trust¹². Researchers should consider what trade-offs are optimal under what circumstances.

To encourage firms to make their data available for research, due-diligence policies should incorporate monetary incentives and smart solutions for data privacy and security. Digital registries might be set up that withhold information that is sensitive, mentions individuals or is competitive, such as lists of suppliers. Scandinavian countries' efforts along these lines could serve as a role model. In the EU, approval of data requests and coordination could be done by the office in the European Commission that is responsible for receiving data and reports from member states.

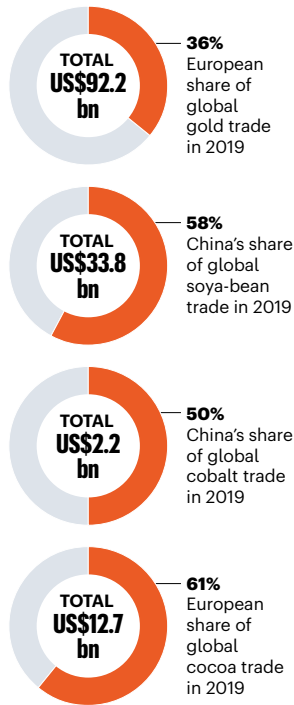
Develop theoretical frameworks. Clear and testable hypotheses are needed to evaluate impacts on sustainability. Questions to be formalized include: under which conditions do due-diligence policies shift negative impacts into other regions or sectors? How might businesses respond to differing standards and competing incentives across their supply chains – for example, will purchasers blacklist companies on the basis of country? And what consequences of lost markets or new standards might there be in supplier countries?

Researchers need to examine how the market leverage of companies that implement due diligence influences a policy's effectiveness,

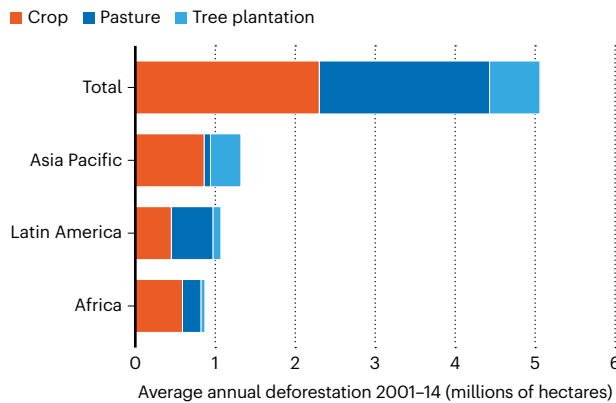
UNSUSTAINABLE SUPPLY CHAINS

From farm to factory, companies struggle to track environmental and social damages linked to their products, such as modern slavery and deforestation.

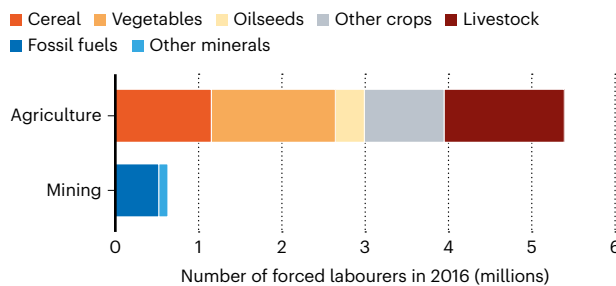
Europe and China dominate imports of some commodities



Tropical deforestation is a widespread problem in farming



Forced labour is rife in agriculture and mining



Some policy choices to protect the environment can also enhance inequities. For example, the United Nations' Minamata Convention, which entered into force in 2017 and aims to phase out mercury pollution, could create inequities if companies and governments favour industrial-scale mining over that done by local communities, which use mercury more often and cannot easily change their approach.

Address root causes. Due-diligence laws can only achieve so much. Shifting to new suppliers will not solve the many systemic problems underlying global trade: weak enforcement of regulations in producer countries, technological disadvantages in low- and middle-income countries and insufficient revenues to invest in better production practices. The scientific community should identify policy mixes that can help to resolve such problems. Researchers should look at demand as well as supply, and forecast the knock-on effects of unhealthy and unsustainable diets, mass consumption, lack of recycling and unsustainable uses of biomass other than food.

Global sustainability requires coherent global governance, and global governance requires effective due diligence. The research priorities outlined here could help to produce it.

relative to those that don't. If a country with a small share of the import market sets high standards, for example, suppliers that don't comply might simply turn to importers with lower standards. This would fragment networks of suppliers and importers, increasing trade costs and reducing economies of scale.

The impacts of shifting sources also need to be studied because these can displace, rather than remove, negative impacts. For example, to minimize transport costs, Europe currently obtains much of its soya from the Brazilian Amazon instead of southern Brazil, even though the risk of deforestation is greater in the former¹³. Forcing importers to supply EU markets with 'deforestation-free' soya might redirect them to other locations. But if deforesting regions find purchasers in less-picky nations, the net effect will be nil. Theoretical criteria need to be set to help policymakers make these complex judgements around sustainability outcomes.

Understand policy interactions. Most case studies and impact evaluations of voluntary policies for supply-chain governance disregard the wider political contexts in exporting and importing countries. Researchers now need to analyse such laws as part of a global policy ecosystem¹⁴.

For example, voluntary commitments among major soya traders to protect Brazil's Cerrado region have stalled owing to political backlash from the Brazilian agricultural lobby. If the EU mandates that companies have to

avoid clearing native vegetation, it might give those firms greater authority to strengthen existing commitments. Alternatively, it could entrench opposition and comebacks against EU-linked firms. This could drive more farmers towards using Chinese companies, for instance, and reduce the leverage of the EU in promoting sustainable soya production.

Differences in how due diligence is conceptualized in importing and exporting countries matter. For example, some higher-income nations might draft laws that effectively ban some products, such as gold mined using sodium cyanide to separate the metal from ore⁸. Producer countries might retaliate against perceived protectionism by setting taxes or tariffs on goods imported from the regions that have such legislation.

Support equity. Due-diligence legislation sets out what companies need to achieve, but not how to do it. There are many options, from incentives to sanctions. Researchers need to understand this mix of policy instruments and the implications for workers in different sectors. For example, to incentivize suppliers to improve their practices, companies might offer higher prices to those that require employees to use protective gear, or national governments might ban unsustainable practices. For example, in 2010, Indonesia prohibited local governments from issuing new licences for palm oil, timber and logging activities on primary forests and peatlands.

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