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IISD REPORT

Meeting China's Global Resource Needs

Managing Sustainability Impacts to Ensure Security of Supply

Synthesis Report

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February 2014

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About this Report

This report summarizes work to date on how **sustainability risks in China's global inward supply chains could be understood and managed to ensure security of supply.**

This report has been prepared by a team led by the International Institute for Sustainable Development (IISD), with support from the UK Department for International Development (DFID).

This report has been led by IISD Senior Fellow, Dr. Simon Zadek, and a combined Chinese and international research and engagement team comprising of Han Cheng, Jason Potts, Gabriel Hupe, Jason Dion, Vivek Voora, and Maya Forstater.

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Errors and omissions in the Report are the sole responsibility of IISD

Comments on the paper are welcomed in English to the Project Director, Simon Zadek (simon@zadek.net), or in Chinese or English to Han Cheng, Project Manager (chenghan528@gmail.com)

Executive Summary

China's growing inward supply chains provide commodities, goods, technologies and services critical to domestic consumption and to export industries. They are increasingly shaping global markets and local economies for trading partners. This trade brings benefits for exporting countries, but can exacerbate a range of social and environmental and governance problems (collectively labelled "sustainability" issues) such as pollution and climate change, biodiversity loss, and conflict over access to water, land and other natural resources in supplier countries. Key concerns over issues such as "land grabbing," "conflict minerals" and "the natural resource curse" highlight the complex nature of issues that involve governments, communities and investors across national boundaries, and in areas of poor governance.

It is increasingly recognized that there is a nexus of interactions between such sustainability issues, and exposure to hazards of supply disruption for importers. The relationship is not direct but is mediated through public institutions and regulations, markets, societies and ecosystems. The nexus varies between companies, sectors and over time and can affect the "accessibility" of resources (for example through natural disasters, social protests or export bans in exporting countries), "affordability" (through price rises) or the "acceptability" of resources (in relation to consumer and public expectations).

Supply chain sustainability issues are strategic risks for China. China's rising imports make it both vulnerable to supply chain risks, and also potentially a key player in developing more resilient and sustainable production practices and effective institutions in the markets where it trades.

A key response to these risks internationally has been the development of supply chain sustainability standards addressing complex issues, such as conflict minerals, security, land grabbing and natural resource revenue governance. Such private, voluntary and collectively developed standards are an increasingly important part of the international market, enabling companies to secure their reputation, professionalize sustainability-related supply chain risk management and collaborate with others to solve common problems.

There is a gap in the strategic management of these risks. While Chinese companies and government ministries are engaging with these issues and standards, it is in a limited, cautious and tactical way without an overall national strategy. This leaves Chinese enterprises, and the Chinese economy exposed to poorly understood systemic risks due to natural hazards, local conflict, and resource nationalism, with individual public agencies and enterprises often acting without adequate coordination or broader guidance.

This paper outlines and tests a commodity-by-commodity framework for assessing sustainability risks and vulnerability for importers. The framework is designed to be applied both at the enterprise (micro) level and at the national (macro) level. The assessment methodology was tested through a desk study looking at two commodities: copper and palm oil, at both an enterprise and a national (China) level (see Figure 1).

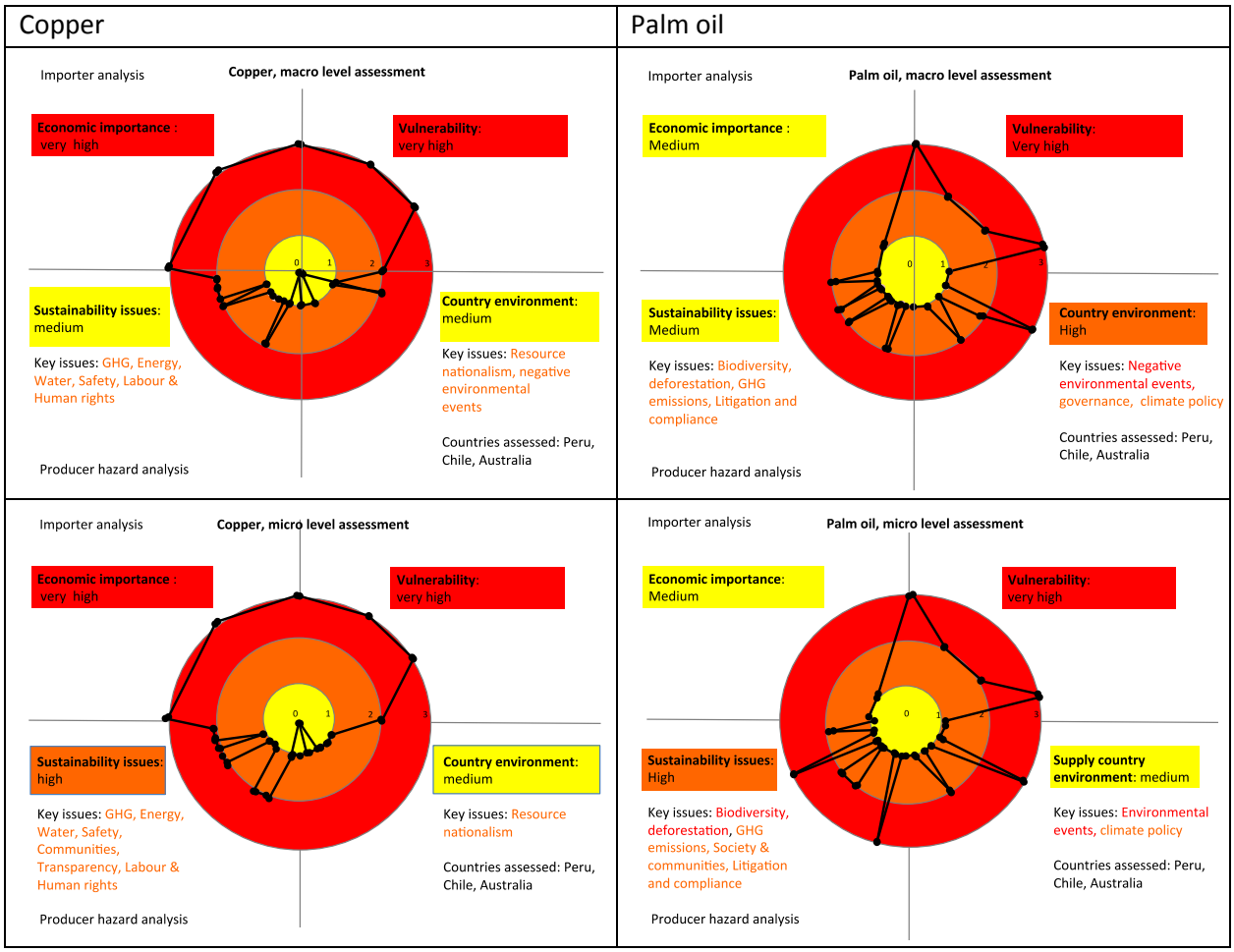

FIGURE 1: SUMMARY OF RESULTS

The analysis reflects copper as a strategic import, which faces a range of sustainability issues, although none of them at critical level. The assessment for palm oil showed lower levels of vulnerability, but potentially greater uncontrolled sustainability risks.

Outreach and consultation around this analysis confirmed the relevance of this approach, the salience of its findings, as well as the gap that exists for an overarching Chinese strategy with regard to such impacts.

It is clear from international and Chinese experience that there are policy measures that can be taken to support better management of supply chain risks. This paper outlines five policy steps, which could be targeted to key product and country risks, and also makes an overarching recommendation to pursue these as part of a strategic approach:

1. *Build supportive capabilities of Chinese embassies and consulates.* The Chinese government through the Ministry of Commerce (MOFCOM) should build the capacity of the Economic and Commercial Affairs Sections of its embassies and consulates to support Chinese companies in identifying and addressing social and environmental impacts.

2. *Strengthen engagement with international standards.* The Chinese government, through MOFCOM and the China National Institute of Standardization CNIS should accelerate its engagement with international standards which relate to strategic commodity supply chains at risk, identifying and addressing key gaps and risks, and building on its existing engagement with standards in areas such as conflict minerals and forests.
3. *Explore fiscal measures.* Fiscal measures may offer a lever for encouraging Chinese enterprises to address their own sustainability footprint, and that of their overseas suppliers. The Chinese government could engage in research to understand the potential of fiscal measures to incentivize the development of sustainable supply chains.
4. *Integrate supply chain sustainability into green public procurement.* Public procurement criteria can provide a further driver to improve sustainability impacts of China's in-bound supply chains. The Chinese government, through MOFCOM, the Ministry of Environmental Protection (MEP) and key provinces could develop and pilot supply chain related green procurement criteria for a limited and targeted set of products.
5. *Develop supply chain risk criteria in existing corporate social responsibility and green business guidelines.* Integrating supply chain risk into responsible business guidelines would make them more useful to companies and investors. This could draw on international best practices and the experience of leading Chinese companies.

An overarching approach is needed for China's international supply footprint to become part of its vision for resilient and sustainable development. One of the most notable findings from the discussions and consultations in developing this project is that there is no ministry or department with an overall vision and mandate for understanding China's import footprint and how it can be managed more effectively. Taking strong action depends on there being an overall vision articulated as part of the broader view of development. The National Development and Reform Commission (NDRC) could consider developing a broader goal and metric of performance on supply chain sustainability, as part of the national planning process in the lead up to the 13th five-year plan, and as part of China's development as an "ecological civilization."

The International Institute for Sustainable Development is committed to working in and with China to advance sustainable development, and views the area of inbound supply chains as a key strategic opportunity to achieve this mutual goal.

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1.0 Introduction

Purpose

China's inbound supply chains—essentially the flow of goods and services into China destined for domestic consumption and as inputs to manufacturing and process industries for export—are amongst the most direct ways in which China's rise impacts economies worldwide. Positively, the growing scale of such flows has generated employment, income, investment and growth in many countries and regions, notably those supplying above and belowground commodities. Negatively, there have been social and environmental or sustainability problems associated with the scale of such flows, again particularly associated with the acquisition of commodities.

Negative social and environmental impacts associated with China's inbound supply chains can have consequences for China. This can be directly through short-term supply disruptions and more broadly through the impact on China's "brand" in international markets, which can affect the ability of Chinese enterprises to access international capital, resources, markets and talent.

Resource scarcity is a key issue for China, as continuing urbanization and growing prosperity intensify demand for water, energy and natural resources, extending both within and outside of national boundaries. At the same time China is seeking to build an "ecological civilization" underpinned by policy, finance, strengthened rule of law and a growing community of innovation. Success in developing such an ecological civilization will be judged both by Chinese Citizens seeking safe food, clean air and water and opportunities to prosper, as well as by the international community that is concerned with China's role as the world's largest trading nation, and soon to be its largest economy. In both cases more effectively managing the social and environmental footprint of China's inbound supply chains is critical.

Demonstrating that China's inbound supply chains are mutually beneficial for both exporting and importing countries, and that they are managed in such a way as to conserve natural resources and contribute to development is crucial to the country's expanding global demand being met by trade openness rather than resource nationalism.

Sustainability risks therefore should count for enterprises and policy makers concerned with China's inbound supply chains. Yet for most companies operating in China, sustainability risks in inbound supply chains are poorly understood and often inadequately managed. There are many reasons for this, some of which are not specific to China or Chinese companies. Open market purchases of many commodities are often made with little or no engagement with producers. Some supply chains are highly complex and involve many middle agents that reduce transparency, and the rapid growth of many Chinese companies has been at the cost of weaknesses in management systems and practices, particularly in relation to long-distance supply chains.

Chinese policy makers are cautious in getting involved directly in inbound supply chain issues, except for a small number of key commodities. Policy interest increases where Chinese producers are involved (through outward investment), and further where the source countries involve strategic considerations for China that go beyond particular companies, investments or supply chains.

Sustainability problems in inbound supply chains are ultimately of interest to China-based companies and Chinese policy makers if they represent a risk to China's business community, its economy, or wider international relations. The low level of engagement of Chinese companies and policy makers to date in such problems is because these risks are seen as small and unimportant, although there is a growing awareness on the part of major Chinese enterprises that reputation increasingly counts.

A further reason for such low interest is that credible tools do not exist for assessing the link between sustainability and security of supply risks. Such tools are increasingly in use by enterprises on the supply side, for example by mining companies assessing the disruptive risks of environmental errors or labour conflicts. Yet they are in their early stages of development for companies on the demand side, and are even less developed for economic policy makers.

This initiative of the International Institute for Sustainable Development (IISD), supported by the UK Government's Department for International Development (DFID), is intended to help overcome this gap by developing and testing a tool for assessing the relationship between sustainability and security of supply risks in inbound supply chains.

Approach

Two mini-pilots have been undertaken to test the method. These were desk-based exercises focused on China's purchase in international markets of copper and palm oil. In a sense, any supply chain chosen would have been relevant and interesting, but these choices were made deliberately to ensure the inclusion of a:

- Strategically significant extractive industry commodity, where China also has major interests through outward investment and the role of state-owned enterprises.
- An agricultural commodity with growing Chinese demand, where sustainability issues have become widely recognized by international brands that have turned to voluntary initiatives involving market and non-market actors to negotiate solutions.

As part of the process of development, the initial concepts, methodology and findings were tested in discussion with business people, policy makers, academics, and NGOs to explore whether the narrative and analysis outlined in this report would be considered useful, and to better understand the opportunities for Chinese policy institutions, and businesses, to collaborate in better monitoring and managing of China's global inward supply chain sustainability footprint. In January 2014, the International stakeholder consultation roundtable was held in Beijing to discuss initial findings with participants from the Ministry of Environmental Protection (MEP), industry associations, academics and policy advisors on trade and investment, state-owned enterprises, as well as civil groups that use and advocate sustainability standards.

Section 2 of this report sets out in brief an analysis of the nexus of interrelationships between supply chain risk and sustainability issues. Section 3 outlines the methodology developed for identifying "hot spots." Section 4 summarizes the results from the two pilot tests of the methodology and section 5 relates the findings from initial outreach to the business and policy maker community in China. Three accompanying technical working papers support this synthesis paper, giving greater detail on the methodology and the two pilot studies.

Finally, worth noting is that the initiative is only an initial step in the development of an appropriate tool for assessing and ultimately better managing the relationship between sustainability and security of supply risks. This synthesis report, therefore, together with the three, associated technical papers are intended to stimulate debate and further work in refining a useful suite of tools fit for purpose.

This is a particularly important issue for China because of its scale and speed of growth, its resource scarcity and its particular role as the world's manufacturing hub, but could also be of value to other countries and their businesses in monitoring and managing global supply risks.

2.0 Understanding the Nexus

It is increasingly recognized that there is a nexus of interactions between supply chain "sustainability impacts," and "hazards to supply." This is mediated through the dynamics of institutions, market societies and ecosystems, which can either exacerbate or ameliorate hazards.

EXAMPLES OF SUSTAINABILITY ISSUES AND COUNTRY ENVIRONMENT HAZARDS RELEVANT TO SUPPLY CHAIN RISKS

Environmental, social and economic impacts of production and trade

- Natural resource revenues and business taxes
- Employment of workers
- Land acquisition
- Biodiversity impacts
- Energy use, GHG emissions
- Pollution management
- Growth in transport and logistics networks
- Revenues to armed groups from "conflict minerals"

Hazards that can disrupt the supply and acceptability of commodities

- Demand shocks
- Weather extremes and natural disasters
- Corruption, illicit trade and organized crime
- Major accidents
- Conflict and political unrest
- Pandemics
- Transport hazards – e.g. piracy, terrorism, infrastructure disruptions
- Resource nationalism
- Scandals and reputation risks

Some key examples of how sustainability issues can become material issues for importing enterprises or companies are outlined below.

TABLE 1: MAPPING THE NEXUS OF SUSTAINABILITY ISSUES AND SUPPLY CHAIN RISKS

	Supply chain risks									
	Price rise/ affordability risk			Supply disruption/ accessibility risk				Reputation/ acceptability risk		
Production associated with:	Resource pressure	Compliance costs	Environmental pricing	Local protests	Contract risk	Accidents, disasters	Export bans	Public concern at home	Consumer concern	International standards
Large areas of land use	■					■	■			
Water use in areas of water shortage	■	■	■	■		■				
High levels of GHG emissions		■	■					■	■	■
High levels of local pollution		■	■	■		■		■	■	■
Deforestation	■	■		■			■	■	■	■
Impacts on biodiversity		■		■			■	■	■	■
High energy use	■					■				
Labour and human rights abuse		■		■		■		■	■	■
Tensions with local communities	■			■				■	■	■
Maintenance and security risks		■				■		■	■	■
Corruption				■	■			■	■	■
Litigation and compliance risks		■								
Concerns over lack of transparency					■			■	■	■

This is a broad-brush analysis of linkages many of which overlap or are inherently linked. However, what the nexus matrix seeks to map out is the means by which sustainability impacts and issues at the production end of the supply chain, such as deforestation, labour-rights abuse or corruption translates into salient concerns for those at the "use" end of the supply chain. In practice the specific relationships between sustainability impacts and commercial risks vary from sector to sector, and over time. Public and consumer concern may apply in many cases, but whether they are a compelling force depends on the type of product, its consumer niche, and the evolving public expectations of brands and sectors. While reputation can play a key role, there are also more direct cases where local sustainability issues lead to supply chain disruption, such as when poor maintenance and safety controls cause a mining collapse, or where labour-rights abuse and poor working conditions lead to strikes and social conflicts.

Policy matters

In addition to these more or less direct linkages between business impacts and risks, public policies and institutions play a key role, either negatively, through reactive and politicized measures such as export bans and expropriation, or positively through development of effective local regulations and policies to address sustainability challenges. Sustainability impacts of inbound supply chains are often not the legal or commercial responsibility of foreign companies and policy makers. For example, when a Chinese company contracts with a global corporation to buy iron ore, or purchases soya through commodity markets, they rarely have any direct responsibility for the behaviour of the producer. It is therefore rightly said that the primary responsibility for regulating the sustainability impact of production rests with domestic authorities in the exporting country. Nevertheless, firms operating internationally can take the initiative of responsibility and avoid employing the lowest standards available.

If trade is to support national development in exporting countries, it is crucial that public and private institutions are able to effectively respond to supply and demand, collect and spend revenues for the public good, regulate the safety of workers and communities, govern land tenure, protect the environment, manage natural resources, build industries and infrastructure and prevent crime. However, booms in international demand for key commodities have often outpaced the development of these national and market capacities, leading to unsustainable development. Such booms are characterized by "honey pot" growth, corruption and poor productivity, as well as a heightened risk of strikes and conflicts, political instability, export freezes and expropriation. These outcomes ultimately damage both the development prospects of exporters, and the security of supply, reputation and profitability of importers.

In this case foreign buyers and policy makers may recognize a mutual interest to help manage risks in the supply chain and contribute to the development of successful local institutions, as well as to secure their own supply and reputation.

Sustainability standards and initiatives as a means to navigate the nexus

Many international corporations are starting to align their approach to sustainability concerns and security of supply. For example, the cocoa sector is experiencing a reduction in both quality and quantity of supplies from West Africa, as farms struggle to achieve profitability in the face of poor infrastructure and an aging rural population. Businesses on the buying side are implementing strategies to raise productivity and the standard of living of cocoa farmers and to ensure a new generation of cocoa farmers, in order both to secure their own supply and to compete against the ethical challenge of "fair-trade" brands. In 2008, the "Cadbury Cocoa Partnership" pledged to spend £44m (USD $87m) over ten years to train farmers (Economist, 2008). The Nestlé Cocoa Plan provides farmer training and incentives and

promotes school attendance (Nestlé, n.d.). Similarly, the Cargill Cocoa Promise is a global commitment to support "sustainable cocoa" and the "long-term security of the cocoa supply chain"; it focuses on farmer training, community support and farm development (Cargill, n.d., para. 3).

On the issue of water, Coca-Cola was driven by reputational concerns, particularly protests in India, to understand and address the role of its business model on local water availability and quality. In 2007 it began to work with World Wildlife Fund (WWF) to understand the issue, and to improve the efficiency of Coca-Cola's global operations and contributing to watershed management and conservation (WWF, n.d. a). The company is also promoting sustainable agriculture across its supply chain by adopting a company-wide set of Sustainable Agriculture Guiding Principles and buying sugar cane, oranges and corn in line with voluntary sustainability schemes such as Bonsucro-certified cane sugar (WWF, n.d. b).

This highlights the role of the new generation of voluntary sustainability standards in providing a means to manage the intersection of sustainability and supply risks. Supply chain sustainability standards, certification schemes and collaborative initiatives have been developed in many sectors to address social and environmental issues related to supply chains. While they have often initially been driven by reputational concerns, they are increasingly also focused on security of supply. Product certification such as Forestry and Marine Stewardship standards provide chain-of-custody certification which offers buyers a means of assurance as to whether the wood or fish was harvested sustainably, and a label to communicate this to customers. Principles based standards such as the International Council for Mining and Metals principles, the Voluntary Principles on Security and Human Rights provide a means for collaboration between companies and with governments to address systemic issues creating supply risk. New collaborative agreements such as the Bangladesh Accord drawn up after the Rana Plaza disaster in 2013 are efforts at formalizing relationships and accountabilities to solve the intransigent problem of safe buildings and working conditions in Bangladesh's garment sector.

Supply chain standards, whether focused on sustainability or product quality and risk management seek to establish a basis for assuring consistent high-quantity continuity along dispersed and complex value chains. They do this not only by creating standards and labels but often by creating whole new sets of institutions on the ground which are able to act as a focus for solving problems that fall between the responsibility of suppliers, buyers and their governments. Such standards should therefore be understood as a means to understand and mitigate risks.

However there are many issues, standards and risks across a wide range of sectors, as well as those that have not attracted the attention of sustainability-standard setters. Which issues and commodities pose the greatest risk, and potential for concerted action in the context of China's inbound supply? The methodology that follows is designed to answer this question.

3.0 Assessment Methodology

To assess the exposure of firms and national economies to supply chain risk, it is necessary to take a commodity-by-commodity approach and to analyze both the demand side factors which make a country or enterprise particularly vulnerable to economic impacts from changes in availability, affordability and acceptability of inputs to its supply chain, and supply side factors that could give rise to those disruptions. The methodology is based on four composite measures, which seek to assess:

- The *economic importance* of the commodity to domestic production, job creation and consumer wellbeing.
- How *vulnerable* domestic users are to changes in price, quality and availability of the commodity.
- Whether *producer sustainability* issues are relevant and likely to impact on supply. This includes issues such as land use, water, climate change, biodiversity and community tensions over resources.
- Whether *supply country* factors pose hazards that may prevent sustainability issues being effectively addressed and act as barriers to the continuity of supply.

The supply risk methodology developed contains an inventory of factors in each of these areas, and gives a framework for rating them on a scale from "low" to "very high" risk in order to identify hot spot areas of supply chain risk.

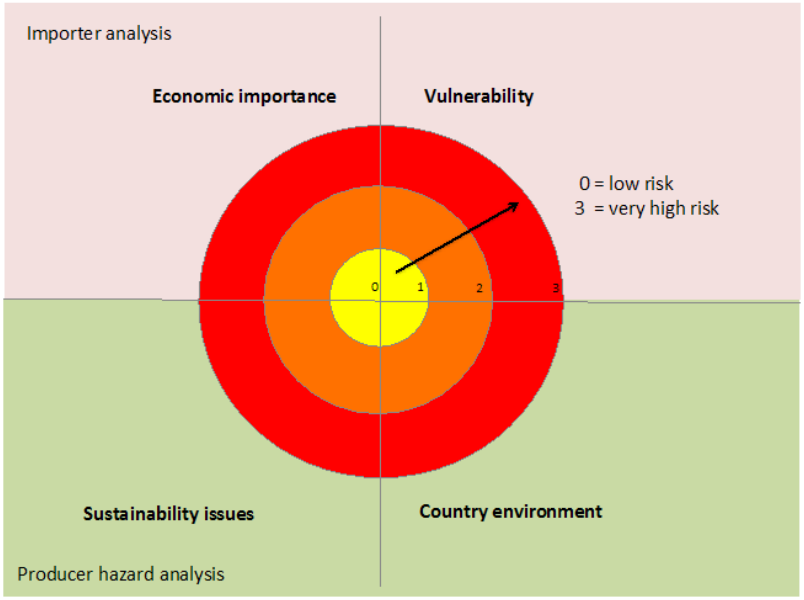

FIGURE 2: ASSESSMENT FRAMEWORK

In each of the four areas a set of publicly accessible indicators were identified. Details of the sources and indicators used are included in Appendix x and summarized below.

TABLE 2: SUMMARY OF FRAMEWORK FOR PILOT STUDY

AREA		AIM OF METRIC	WHY IMPORTANT?	INDICATORS USED IN THE PILOT STUDY
Importer context (demand side)	Vulnerability	Assess difficulty to meet commodity consumption needs if current supply was disrupted.	Commodities where disruptions difficult to address by "buying somewhere else."	• Imports as share of global production • Imports as share of global imports
	Economic Importance	Assess the importance of the commodity to key sectors of the national economy.	Commodities with greatest strategic importance to policy makers and business.	• Commodity imports per capita • Commodity imports per GDP • Import dependence • Concentration of foreign supply
Producer and country hazard (supply side)	Sustainability issues	Asses exposure to risks related to environmental, social and governance issues that could effect supply base.	Commodities where sustainability issues could become supply chain disruptors.	Risks related to: • Level of land use • Level of water use • GHG intensity • Pollution concerns • Biodiversity impacts • Energy use • Labour and human rights • Competing community expectations and claims on resources • Maintenance • Corruption • Litigation • Lack of transparency
	Country environment	Assess relevant institutional, governance and market weaknesses related to exporter country.	Country sources where environmental, social and governance risks and their impacts likely to be poorly controlled.	Risks related to: • Climate policy • Resource nationalism • Natural hazards • Trade openness • Governance • Market competition and infrastructure • Inadequate information by producers

Assessments for each of the indicators were indexed to a scale of 0 to 3 representing low (0), medium (1), high (2), or very high (3). This approach keeps the assessment straightforward and accommodates both qualitative and quantitative evaluations. For the assessment of individual hazards related to producer sustainability issues and supply country environment, a risk assessment approach was used to create an index based on "loss exposure"—a metric that assesses the implication of the hazard for the particular commodity sector in terms of its impact on the access and acceptability of supply. Loss exposures were individually assessed by looking at a number of constituent components—the hazard's relevance to the sector, the share of supply impacted by the hazard, the prospective impact of the hazard, and its likelihood of occurrence. Each component was rated as between 0 (low) and 3 (very high). The overall loss exposure scores for each issue and country risk area is the average of the relevance, share of supply, impact and likelihood scores.

4.0 Pilot Studies

Two pilot studies were completed to provide illustrative examples of the application of the security of supply tool. The tool was applied to China's copper ore and palm oil supply chains. The results as well as the implications are discussed below, with further detail in appendix 1.

TABLE 3: COPPER ORE

Component	Micro (enterprise)	Macro (country)
Economic importance	Very high	
Vulnerability	Very high	
Sustainability issues	High	Medium
Country environment	Medium	Medium

Sustainability issues	Land use	Low	Low
	Water use	High	High
	GHG emissions	High	High
	Pollution	Medium	Low
	Biodiversity	Medium	Medium
	Deforestation	Medium	Medium
	Energy efficiency	High	High
	Labour and human rights	High	High
	Society and communities	High	Medium
	Maintenance and safety	High	High
	Corruption	Medium	Medium
	Litigation and compliance risks	Medium	Medium
	Transparency	High	Medium
Country environment	Climate change policy	Medium	Medium
	Resource nationalism	High	High
	Natural and environmental disasters	Medium	High
	Strength of governance	Medium	Low
	Trade and interconnectivity	Medium	Medium
	Competition and markets	Medium	Medium
	Knowledge & access to information	Low	Low

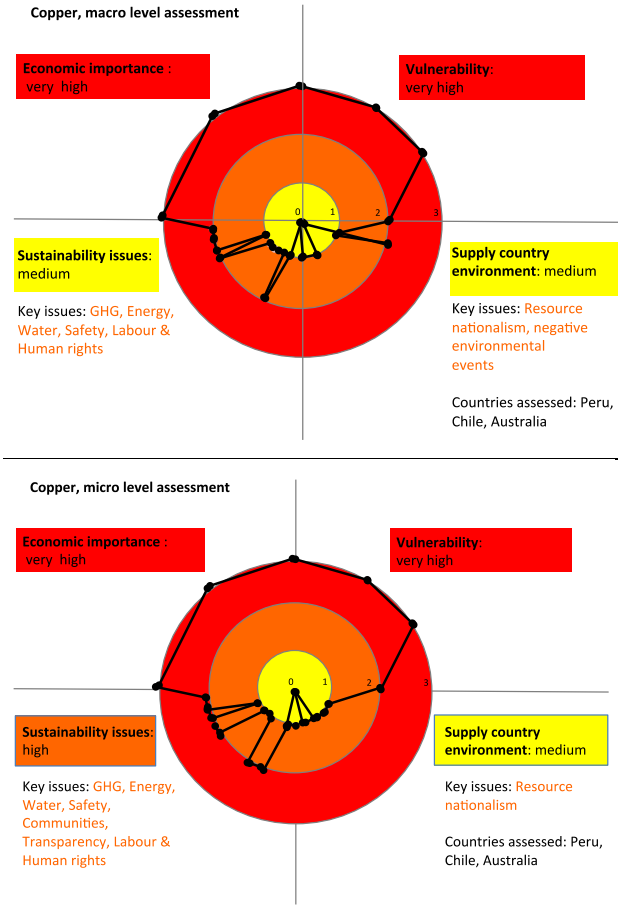

FIGURE 3: COPPER ASSESSMENT

Vulnerability – Very High

China is the world's largest importer and consumer of copper, with import volumes totalling 37 per cent of global copper trade volumes. Importing approximately $46 billion USD of copper in 2010, China is 68 per cent dependent on imports to supply its domestic manufacturing needs. Therefore, despite being one of the world's largest producers of copper, China is heavily reliant on other countries for copper supplies. Globally, only 4 per cent of the world's estimated copper ore reserves are located in China. With the rate of exploitation steadily increasing by 8 per cent per annum over 2006–2011, reserves in China are expected to run out by 2024. A large share of copper imports is sourced in relatively few countries with around 45 per cent of China's imports of copper ores and concentrates, copper scrap and refined copper originating from Chile, Australia and the United States. Chile, Peru and Australia supply 60 per cent of China's copper ores, concentrates and refined copper. However, China also imports significant quantities from Mongolia, United States and Mexico which helps to offset vulnerability. Greater recycling of copper is a possibility, but Chinese demand for copper is expected to continue to grow and therefore supplies need to be secured regardless of the degree of recycling. Imports from African countries including Tanzania and Zambia have also been increasing in recent years.

Economic importance – Very High

The value of China copper imports represents about 0.8 per cent of China's GDP, suggesting a key role for copper imports in the economy. The top consumers of copper are the electric power industry, electronics and communication technologies, machinery and equipment, transportation, and construction industries (Shang, Zhao, Duan & Zhou, 2010) The electric power industry accounts for 42 per cent of copper consumption, while the electronics and consumer goods industries each represent 15 per cent of consumption. China's continued development of its energy infrastructure therefore depends on supplies of copper. Global copper consumption is expected to double by 2035, with China representing 68 per cent of this increase (Potts et al., 2011). Copper is a key input to the electronics manufacturing industry which employs approximately 3 million people, contributing approximately 10 per cent to overall GDP growth

in the last few years (Shang et al., 2010; APCO, 2010). China is also the third largest exporter of semi-fabricated copper products, after Russia and Germany (ICSG, 2013). Chinese companies have established growing foreign direct investment in key supply countries such as Chile, Peru, Zambia and Mongolia.

Sustainability issues – High Micro and Medium Macro

The environmental consequences of the mining process are substantial and have both acute and chronic effects on the geography, water, vegetation and biological life in the surrounding areas (Wilson & Pyatt, 2007; Kant, Sharma, Roy & Pandey, 2007). Mines produce large amounts of waste as tailings and contaminate the soil through acid mine drainage (Wilson & Pyatt, 2007; Kant, Sharma, Roy & Pandey, 2007). This can result in inability to sustain life in badly affected areas (Wilson & Pyatt, 2007; Kant, Sharma, Roy & Pandey, 2007). Because of these effects, copper production can dramatically affect biodiversity in the surrounding area, and a recently proposed copper mine in a national park in Zambia was rejected for this reason (Mutterback, 2013). Greenhouse gas emissions are one of the most prominent areas of concern with respect to the environmental impacts of copper production. These emissions are primarily driven by energy consumption in the industry (Farrell, 2009). Low-grade open pit mines are particularly energy intensive. In 2007 it was estimated that each tonne of global copper production required 35.7 gigajoules of energy, and resulted in 2.45 tonnes of CO_2 emissions (Farrell, 2009). Impacts on water are also notable. All aspects of copper production—from mining and leaching to milling, smelting, and refining—have potential impacts on surface and groundwater quality. Adverse water quality impacts are caused primarily by land disposal practices that fail to contain wastes, by run-on and run-off controls that are inadequate to prevent surface water from flowing through impoundments, or by groundwater infiltrating surface impoundments. In addition, the large-scale land disturbances associated with open-pit mining may disrupt the natural flow of surface and groundwater, and may lower the water table in the mine area (U.S. Congress, 1988). Impacts on human health can also be substantial, with products of the copper smelting processes acting as lung irritants that can aggravate asthma. Toxic pollutants such as lead and arsenic can also be a problem if not adequately controlled.

Workers' rights, impacts on indigenous lands, issues of benefit sharing, corruption, regulatory compliance and transparency are all significant factors affecting a mine's social license to operate. Generally, employees are exposed to the highest concentrations of toxic elements because they work in enclosed areas (Wilson & Pyatt, 2007; Kant, Sharma, Roy & Pandey, 2007).

Major copper mining companies such as Codelco, Rio Tinto, Freeman McMoRan, Xstrata, BHP Billiton and Rio Tinto have invested significantly in developing sustainability management and reporting processes covering these issues. Many are members of the International Council on Mining and Metals and are signed up to its principles, as well as to the Voluntary Principles on Human Rights and Security, the Extractive Industry Transparency Initiative (EITI), and the Global Reporting Initiative, driven by concern for their license to operate, access to capital and management of operational and reputational risks.

Country environment – Medium Micro and Medium Macro

The two greatest foreign country supply hazards in the copper sector facing the national level in China are resource nationalism and natural disasters and negative environmental events. Resource nationalism in the main supplier countries of Peru, Chile and Australia has been assessed in Maplecroft's Resource Nationalism Index, which looks at

factors such as risk of outright nationalization and expropriation, export freezes or restrictions, and increases in taxes on revenues, as being at a medium risk level (Maplecroft, 2013). The fact that resource nationalism presents significant risks across all of China's main suppliers indicates that the overall risk level is significant. The risk of natural disasters and negative environmental events are pronounced in Peru and Chile, two major suppliers.

Implications

TABLE 4: COPPER SUPPLY RISK – NEXUS ASSESSMENT

	Supply chain risks									
	Price rise and volatility/ affordability risk			Supply disruption/ accessibility risk				Reputation/ acceptability risk		
Production associated with:	Resource pressure	Compliance costs	Environmental pricing	Local protests	Contract risk	Accidents, disasters	Export bans	Public concern at home	Consumer concern	International standards
Large areas of land use										
Water use in areas of water shortage										
High levels of GHG emissions										
High levels of local pollution										
Deforestation										
Impacts on biodiversity										
High energy use										
Labour and human rights abuse										
Tensions with local communities										
Maintenance and security risks										
Corruption										
Litigation and compliance risks										
Concerns over lack of transparency										

Level of importance: Very High (3) High (2) Medium (1) Low (0)

This analysis highlights the high levels of vulnerability of China's economy, and of enterprises in key sectors to disruption to the supply of copper. While copper is a relatively homogenous commodity, and individual firms enjoy the possibility of shifting sourcing from one supplier nation to another, at the national level disruption to any of the major suppliers would likely have significant impacts. Furthermore, resource nationalism may increase across more than one country, leaving enterprises exposed to critical impacts.

The copper industry involves significant environmental, social and governance issues through its intensive use of energy, impacts on the environment and biodiversity, health and safety issues and tensions with societies and communities. As an industrial commodity product there is low consumer or public concern in the user country, however poor environmental, social and governance performance can result in significant risks in producer countries, leading to protests and social unrests on mining sites, and to the risk of government action which can adversely impact on supply; such as through refusal of mining permits, or uncertainty over taxation leading to lower investment.

While the scoring methodology focused on country risks related to the three largest producers (Chile, Australia and Peru) and found moderate levels of risk of resource nationalism, country risk is likely to be greater in newer sources of supply, such as Zambia and Mongolia, where Chinese companies are also established at the producer end, but where national frameworks for environmental and social regulation and resource revenue management are subject to significant political risk. For example, there is political and public concern that in Zambia the growing copper mining industry is not contributing sufficiently to national development. Safety and corruption concerns have also contributed to resource nationalism in the country. Companies are coming under greater scrutiny for their tax and revenue payments, employment conditions and environmental standards, however many fear that this is taking place in a politicized environment rather than through the rule of law (Caulderwood, 2013).

TABLE 5: PALM OIL

Component	Micro (enterprise)	Macro (country)
Economic importance	Medium	
Vulnerability	Very high	
Sustainability issues	Medium	High
Country environment	High	Medium

Sustainability issues	Land use	Medium	Medium
	Water use	Medium	Medium
	GHG emissions	High	High
	Pollution	Medium	Medium
	Biodiversity	Very high	High
	Deforestation	Very high	High
	Energy efficiency	Medium	Medium
	Labour and human rights	Medium	Medium
	Society and communities	High	Medium
	Maintenance and safety	Medium	Medium
	Corruption	Medium	Medium
	Litigation and compliance risks	High	High
	Transparency	Medium	Medium
Country environment	Climate change policy	High	High
	Resource nationalism	Medium	Medium
	Natural and environmental disasters	Very high	Very high
	Strength of governance	Medium	High
	Trade and interconnectivity	Medium	Medium
	Competition and markets	Medium	Medium
	Knowledge & access to information	Medium	Medium

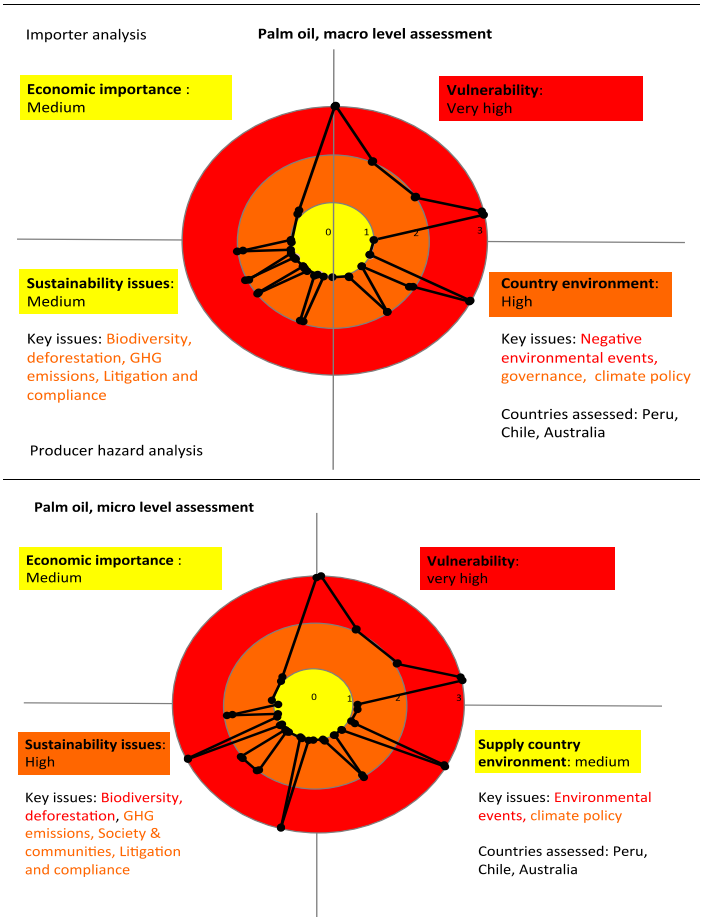

FIGURE 4: PALM OIL ASSESSMENT

Vulnerability – Very High

China is the world's second largest importer and third largest consumer of palm oil, with import volumes totalling 20 per cent of global palm oil trade volumes and 16 per cent of total palm oil produced globally. China is 98 per cent dependent on imports to supply its domestic consumption needs, which are expected to reach about 6.6 million metric tonnes in 2013 (Index Mundi, 2013a). The national supply security of palm oil is especially vulnerable to supply disruptions because global palm oil production is concentrated in relatively few countries. About 96 per cent of Chinese palm oil imports originate from Malaysia, Indonesia or India. Palm oil is the second most consumed vegetable oil in China after soybean oil (Ying, 2011). Because of the dominance of two particular countries in the supply chain, an impact in Malaysia or Indonesia could strongly impact security of supply.

Economic importance – Medium

The value of palm oil imports represents about 0.1 per cent of China's GDP. Key importing sectors include consumer goods manufacturers in the food and consumer products industries, restaurant chains, and agricultural commodity traders. Palm oil is used in many Chinese foods, including instant noodles and fast foods which are becoming increasingly popular in the country. Its advantage is that it is relatively cheap compared to other vegetable oils, however it can be substituted. Whereas fast food chains like MacDonald's and Yum! Brands restaurants (KFC, Pizza Hut and Taco Bell) are currently some of the largest palm oil consumers in China, other restaurants and food producers also procure large amounts of palm oil. In 2011, among the importers of palm oil in China, foreign investment enterprises and private enterprises accounted for 80 per cent of palm oil imports (GEI, 2013). Chinese demand for palm oil is expected to grow 10 per cent per year, reaching 8.6 million tonnes in 2015 and 12 million tonnes in 2020 (Ying, 2011). This increase in demand is mainly attributable to food uses to meet per capita consumption increase. In terms of the Chinese economy, a shock to the palm oil supplies would impact some food processing sub-sectors, but would likely extend no further.

Sustainability Issues – High Micro and Medium Macro

The most significant environmental impact associated with palm oil is deforestation and greenhouse gas emissions, particularly in Malaysia and Indonesia. Estimates suggest that between 2005 and 2010, approximately 30 per cent of oil palm expansion in Malaysia and Indonesia occurred at the expense of natural forests, and over the same period, approximately 30 per cent of forest loss was due to conversion to oil palm plantations. In Indonesia, rainforests and carbon-rich peatlands were destroyed at a rate of 1.1 million hectares annually between 2000 and 2005, endangering species including Sumatran tigers and orangutans. The orangutan, whose habitat is severely threatened as a consequence of expanding cultivation, has become the public face of the negative biodiversity impacts of palm oil (Greenpeace, 2012). In May 2011, the government of Indonesia established a two-year moratorium on new concessions for the clearance of rainforests and peatlands, including for pulp and oil palm plantations.

In terms of social impacts, oil palm expansion in Malaysia and Indonesia has been subject to a large number of land disputes, with local people saying they have been forced off their land. Palm oil companies typically do not consult local communities sufficiently, and tend to work through the government or the heads of communities, which are also prone to corrupt practices (Colchester & Chao, 2013). Worker health and safety is also a concern due to the application of poisonous pesticides, and poor living conditions at plantation barracks (Colchester & Chao, 2013). Corruption, litigation, compliance and transparency are significant risks as well. Between May and September 2013, widespread wildfires were claimed to have been set up deliberately to clear land for new palm oil plantations in Indonesia, a practice that is illegal (NASA, 2013). Ghost palm oil estates which operate without the necessary permits are also a problem.[1]

Country environment – Medium Micro and High Macro

The greatest country supply hazards facing China and Chinese enterprises are resource nationalism, negative environmental events, and climate policy. Thirty-seven per cent of palm oil imports come from countries with high or extreme political risks according to the Maplecroft Political Risk (Dynamic) Index (Maplecroft, 2013). Indonesia is perceived as especially risky due to a high and increasing resource nationalism that gives rise to risks of nationalization and expropriation, export freezes or restrictions, and increases in taxes on revenues. The risk is moderate in Malaysia, the other major supplier.

[1] One of the largest owners of palm oil plantations, Burmitama Agri Ltd., which controls 200,000 hectares of plantation has recently been blamed for taking part in illegal clearing of hundreds of hectares of peatland and forest in clear violation of national laws. At least 7,000 hectares of ghost estates have also been found in Burmitama's land bank. It is reported that palm oil giant Wilmar International purchased more than half (56 per cent) of Burmitama Agri's palm oil, thereby bringing illegal palm oil into their supply chains (FOE, 2013; FOE Europe, 2013).

Implications

TABLE 6: PALM OIL SUPPLY RISK – NEXUS ASSESSMENT

	Supply chain risks									
	Price rise and volatility/ affordability risk			Supply disruption/ accessibility risk				Reputation/ acceptability risk		
Production associated with:	Resource pressure	Compliance costs	Environmental pricing	Local protests	Contract risk	Accidents, disasters	Export bans	Public concern at home	Consumer concern	International standards
Large areas of land use										
Water use in areas of water shortage										
High levels of GHG emissions										
High levels of local pollution										
Deforestation										
Impacts on biodiversity										
High energy use										
Labour and human rights abuse										
Tensions with local communities										
Maintenance and security risks										
Corruption										
Litigation and compliance risks										
Concerns over lack of transparency										

Level of importance: Very High (3) High (2) Medium (1) Low (0)

While Palm Oil does not represent an economically critical import for China in the same way as copper, it poses particular concentrated supply-side hazards related to deforestation, and associated greenhouse gas emissions, biodiversity losses and conflicts with local communities. This is a systemic problem affecting the palm oil industry in major exporting nations, and the reputation of palm oil as an ingredient.

These hazards may disrupt supply, however this is not seen as a major problem, as palm oil is substitutable with other vegetable oils. However the key pressure to address palm oil's reputational risks is for Chinese oil traders and food brand manufacturers to seek to trade internationally and with international brands in China. Responsibly sourced and "deforestation free" palm oil is increasingly becoming an industry standard for global brands such as Unilever and L'Oreal. Many companies are working together through initiatives such as the Roundtable on Sustainable Palm Oil (RSPO) whose participants include environmental NGOs, banks and investors, growers, processors, manufacturers and retailers of palm oil products and social NGOs. They have established global guidelines for producing palm oil sustainably and set up a system of third party inspection to enable transparency and traceability. RSPO members produce about 40 per cent of the world's palm oil and are processors or users of more than 30 per cent. Between 2011 and 2013, Chinese RSPO membership has grown from four to 17 companies and a China Working Group to help build the momentum for transforming the Chinese palm oil industry.

5.0 Learning and Next Steps

Stakeholder feedback

As part of this pilot study, initial input on views on sustainability and supply security, and on the approach and methodology itself, were collected through outreach to relevant experts and stakeholders amongst academics, government associations, industry representatives, and NGOs. Individuals responded both by survey and interview, and through a roundtable discussion held in Beijing. Key findings from this engagement with Chinese stakeholders was that:

- The terrain of sustainability issues related to diverse commodity sectors, from agriculture, forestry and fisheries to oil, gas, mining and minerals is complex, and only a small portion of the relevant stakeholders were brought to the table. Nevertheless the discussions generated around the copper and palm oil cases were able to raise general conclusions and possibilities in addition to specific analysis.
- The relevance of the subject was confirmed. Those concerned with security of supply both on macro policy and micro business level valued the opportunity to assess risks related to sustainability. Respondents recognized the importance of managing sustainability issues in strategic supply chains, but reflected that as yet little attention has been paid to how to implement this.
- The strongest case for attention to supply chain sustainability issues was seen when there are Chinese business interests at both ends of the chain, either as independent producers, or as a subsidiary of the importing parent company in China. Chinese companies, including state owned enterprises, operating internationally face risks arising from sustainability issues which may impact on legal compliance, their license to operate, their cost base and their reputation, in turn impacting on sustainability of supply for import dependent industries at home.
- Discussions confirmed the need for a robust and credible methodology for assessing sustainability related supply chain risks. The methodology as piloted here is still at an early stage. However, we are encouraged to go more in depth, in order to clarify more directly how it can support enterprise-level risk assessment and how it links to macro-level country risks, as well as to be applied in different context and for micro businesses. Those who were already users or advocates of sustainability standards welcomed the approach as a means to understand how best these initiatives could garner the interest of policy makers and business decision makers by addressing particular "hot issues."
- Significant supply challenges associated with sustainability impacts in copper and palm oil have been acknowledged, with links to country level risks among many characteristics. Respondents confirmed that there is low policy interest in security of supply of palm oil, as it is not seen as a strategic commodity and is replaceable by other oils, but significantly more interest in copper.

Methodological development

The initial application of the methodology demonstrated its viability and feasibility, but was limited. For example:

- For some proposed indicators there was not enough readily accessible data, and assessment of risks was carried out at a broad level, looking at global and national trends in each sector. These could be strengthened in future iterations.

- While the framework is designed to be applied at enterprise and national level, enterprise data was particularly limited, so for example the assessment of vulnerability and economic importance was only carried out at a macro level, and used to inform both analyzes. The assessment of enterprise level sustainability and country risks was also limited due to a lack of readily available and comparable data. However if the framework was by a company they would be able to source this data internally.
- Only a limited number of exporter countries were included in the analysis. For palm oil this covered 98 per cent of supply, but for copper it was only 60 per cent, covering Chile, Australia and Peru.
- Country and producer hazards information was difficult to obtain. Some country indices which aggregate large amounts of information, like Transparency International's Corruption Index, the UN Human Development Index or the Maplecroft's Political Risk Index were helpful for some elements. Other sources of publicly available information such as formal published documents by the originating country or newspaper articles were also helpful.

While the tool allows for risk levels to be averaged across the broad range of sustainability and country environment-related hazards analyzed, to give a general rating for each quadrant, care should be taken, as these average ratings can mask particular issue specific risks which on their own could give rise to supply chain disruption. An overall risk rating per commodity is perhaps less useful than the underlying analysis of the particular areas of economic importance, vulnerability, and supply chain relevant sustainability issues and country environment weaknesses.

The tool has been developed in such a way that it offers a significant amount of flexibility for applying it to examine various commodities within multiple countries. Consequently, numerous concrete opportunities exist to further apply, test and refine the tool developed. An obvious place to start is to apply it to a broader range of commodities and raw materials. Additional sectors of interest could include forestry, fisheries and textiles. Applying the tool to assess the security of supply for more finished goods such as those found in the electronic and garment industry may also be insightful in terms of identifying additional hazards that may have been overlooked in this study. Beyond its application to goods, the tool could potentially be modified to examine its application within services supply chains which could include the tourism, transportation and banking sectors. This type of application would likely require more reflection related to the types of hazards that the services sector is subject to, in addition to the ones that have been identified.

The adoption of the tool by specific stakeholders could assist with demonstrating its utility and potential sustainable development impact. Voluntary Sustainability Standards are well placed to adopt, explore and demonstrate the tool's potential utility since they advocate for and facilitate production and business practices to enhance sustainable development. The adoption of this tool by VSS would be very insightful in terms of how it can be modified to best suit their needs and track the potential impacts they may be having, by securing the supply of various commodities while simultaneously enabling sustainable development.

It will be important to examine the tool's potential integration with existing security of supply chain methods and approaches within the private and public sectors.

6.0 Conclusions and Policy Implications

This project has demonstrated a systematic approach to assessing sustainability-related security of supply risks, at both an enterprise and a national level. The methodology is an initial foundation to build upon. It demonstrates the feasibility and relevance of applying a common framework to identify hot spots before they become crises, and systematically drawing policy makers' attention to them.

China's impact on the world through its global supply chains is a strategic issue for immediate security of supply in key commodities, for building a sustainable supply base to meet growing demand, and for shaping the perspective of other nations on the rise of China. As China's inbound supply chain footprint becomes more important to the world, it should also become more important to policy makers, and to enterprises.

There is a gap in the strategic management of these risks. Currently these issues are addressed in a piecemeal and reactive way through enterprise level or policy specific actions confined to particular sectors or countries. This leaves Chinese enterprises, and the Chinese economy exposed to systemic risks due to natural hazards, local conflict, and resource nationalism, with individual public agencies and enterprises often acting without adequate coordination or broader guidance. Supply chain sustainability must be recognized as a strategic issue, not just a tactical one if it is to be tackled in a professionalized manner reflecting its importance.

It is clear from international and Chinese experience that there are policy measures that can be taken to support better management of these risks. As the previous chapter highlighted, the strongest argument for attention to supply chain sustainability issues is seen in cases where there are Chinese business interests at both ends of international supply chains.

The policy measures outlined below therefore target the capabilities and incentives of Chinese companies both as foreign producers and as importers into China.

1) Build supportive capabilities of Chinese embassies and consulates

The Chinese government should build the capacity of the Economic and Commercial Affairs Sections of its embassies and consulates to support Chinese companies in identifying and addressing social and environmental impacts.

Small and medium enterprises (SMES) are often poorly informed and advised about social and environmental impacts. Chinese enterprises in particular have little experience of engaging with diverse non-governmental organizations, labour unions and informal citizens groups and the media. Commercial attaches are often not able to provide the support that is needed.

Recognizing the need to build the capacity of overseas business to respond to social and environmental risks, other governments have invested in supporting their own businesses abroad to address strategic social and environmental issues. UK Trade and Investment for example provides country risk analysis (including in relation to corruption and human rights) and has country specialists embedded in high commissions able to advise on these issues. The Foreign and Commonwealth Office also provides guidance on key issues such as extractive industry transparency and conflict minerals, and has supported specific training on ecosystems and sustainability.

The Ministry of Commerce (MOFCOM) could build the capacity of its local Economic and Commercial Affairs sections to provide support for Chinese enterprises in understanding and responding not only to immediate regulations, but also to broader social and environmental issues. This could be carried out through seminars, trainings and development of guidance in partnership with one or more core support institutions in China such as a business school, as well as international partner organizations, as well as through cooperation with local business groups, Chambers of Commerce and bilateral business clubs.

2) Strengthen engagement with international standards

The Chinese government, through MOFCOM should accelerate its engagement with international standards which relate to strategic commodity supply chains at risk.

Many of the issues relating to the environmental and social impacts of production and trade are likely to remain outside of the control of individual Chinese enterprises, even with awareness-raising and support. Complex issues, such as conflict minerals, "land grabbing" and natural resource revenue governance are being addressed through international, voluntary, multi-sector guidelines and collaborations that seek to define expectations, ensure transparency, or deliver community development support.

Such private, voluntary collectively-developed standards are an increasingly important part of the international market, enabling companies to secure their reputation, professionalize sustainability-related supply chain risk management and collaborate with others to solve common problems. The standards and their associated institutions create processes and on-the-ground institutions which can address collective action problems that go beyond the legal responsibility or capacity of any one company. They can provide the basis for both early warning of sustainability risks, and for increased resilience, solving problems, raising consistency, productivity and quality and mitigating sustainability and associated reputational risks. Chinese companies are beginning to become involved in a limited and cautious way—such as the Chinese members of the RSPO, or Chinese companies applying the Forest Stewardship Council and other sustainable forestry standards. However, these standards are still principally applied to exports for conscious multinational customers, more focused on domestic China impacts and typically do not consider the whole value chain including inbound global supply.

China has developed significant experience and expertise in engaging with and applying ISO-type standards, but has less experience of those standards involving international organizations, civil society, governments and competitor companies. China is increasingly engaging with these standards, e.g. the UN Global Compact and Forest Stewardship Council. The MOFCOM-linked Chinese Chamber of Commerce for Minerals Importers and Exporters is working to provide guidance for member companies, including on due diligence guidance for responsible supply chains of minerals from conflict-affected and high-risk areas and the Extractive Industries Transparency Initiative.

MOFCOM together with the China National Institute of Standardization could play a key role in identifying, and engaging with supporting companies to implement key standards. An international partner such as IISD, that has experience across multiple standards but doesn't promote any particular standard, could also potentially play a supporting role.

3) Explore fiscal measures

The Chinese government could engage in research to understand the potential of fiscal measures to incentivize the development of sustainable supply chains.

Fiscal measures can incentivize companies to improve their own sustainability performance but can also support the goal of improving China's overall reputation and performance in global procurement. There are the beginnings of a fiscal regime sensitized to supporting green investment, the greening of manufacturing and the promotion of energy efficiency and green energy within China. Similar measures could be used to support Chinese companies developing sustainable sourcing practices, and companies that are directly investing in the sustainability of global value chains that are of strategic interest to China. While producers operating as permanent establishments in foreign countries will be subject to local tax regimes, fiscal incentives might be applied to parent companies to improve their social performance overseas and enhance security of supply into China. Exploring the potential for such measures would require further research.

> The Ministry of Finance together with key research institutes such as the Development Research Center of the State Council or the China Academy of Social Sciences (CASS) as well as one or more international institutions could undertake research to map international experience and possibilities in the context of Chinese investment and taxation frameworks and key strategic commodities.

4) Integrate supply chain sustainability into green public procurement

Public procurement criteria can provide a further driver to improve sustainability impacts of China's inbound supply chains.

Public procurement is an emerging policy tool to promote a green and sustainable economy. The Chinese government, through the Ministry of Finance, the National Development and Reform Commission (NDRC) and the Ministry of Environmental Protection (MEP) has moved to implement green procurement since 2004, as a driver for green industrial development and environmental protection in China, however there remain significant gaps in implementation. Green procurement criteria to date have been focused primarily on product performance (such as energy efficiency), and secondly on in-China environmental footprint. It has not generally taken a supply chain approach.

> Sustainable supply chain risk assessment criteria could be piloted for key commodities and products through a collaboration between MOFCOM and MEP, perhaps working with specific provinces. The first step would be to identify a limited number of targeted products where there is a significant public procurement supply chain footprint combined with sustainability-related risks. IISD has carried out sustainable public procurement support for governments including Chile, South Africa and Vietnam, and is secretariat for the Partnership for Procurement and Green Growth, and could provide support for this.

5) Develop supply chain risk criteria in existing CSR and green business guidelines

There is significant outbound Chinese investment associated with China's inbound supply chain, raising the possibility of using existing measures associated with outward investment to address in-bound supply risks. Most Chinese outward investment receives investment from China's financial markets, public and private. There are growing practices introducing sustainability risk assessments into those investments, both by individual investors such as China Exim Bank and the Industrial Development Bank and more systemically such as through the Green Credit Guidelines issued by the China Banking Regulatory Commission (CBRC). These risk-based approaches do not currently take account of potential security of supply disruptions from those investments, but would be more robust and useful to investors if they did.

The Chinese government has developed several corporate social responsibility (CSR) guidelines to shape the approach of Chinese companies in their out-bound investment including those developed by SASAC (State-owned Assets Supervision and Administration Commission) and MOFCOM. These guidelines have drawn on international best practice. Similarly best practice has been developed for supply chain due diligence (such as by the OECD in relation to conflict minerals). Building China supply risk assessments into China's business guidelines could strengthen them and make them more useful to those applying them.

The CBRC could issue more detailed policy guidance for banks focused on assessing environmental and social risks related to overseas investment and supply chains, this could build on the risk assessment approach demonstrated here, as well as the Equator Principles for project finance. Similarly in-bound supply risks could be integrated into future revisions of SASAC and MOFCOM guidelines for overseas enterprises.

6) Make supply chains part of China's vision for sustainability

Make the sustainability impacts associated with China's growing global footprint an explicit part of China's broader vision in promoting an ecological civilization.

One of the most notable findings from the discussions and consultations in developing this project is that there is no Ministry or Department with an overall vision and mandate for understanding China's import footprint and how it can be managed better for broader impact. While there are a wide range of potential levers and opportunities to improve China's global footprint, implementing them in practice and with ambition depends on there being an overall vision, for how inbound supply chains relate to China's emerging development as an ecological civilization and its commitment to sustainable development and green growth.

Consideration of China's international footprint should be integrated into the strategies of the NRDC and the emerging national vision for an ecological civilization

The NDRC could consider developing a broader goal and metric of performance on supply chain sustainability, as part of the national planning process in the lead up to the 13th five-year plan.

The table below summarizes these recommendations, in particular highlighting the relevant ministries and institutions for implementation, the means to take them forward on a limited basis focusing on key commodities, and the kinds of businesses that would be targeted by each approach. The commodity risk-assessment methodology developed for this project could provide an analytical basis for this piloting approach—highlighting key commodities, countries, products and related standards which merit earliest attention.

TABLE 7: SUMMARY OF OPTIONS AND RECOMMENDATIONS

Recommendation	Relevant Ministries and Institutions	Piloting model	Relevant businesses			
			SMEs/ private businesses operating internationally	Chinese multinationals/ SOEs operating globally	Vertically integrated producers/ importers	Chinese enterprises importing/ procuring from global supply chains
Build supportive capabilities of Chinese embassies and consulates	MOFCOM, Ministry of Foreign Affairs, Business Schools	Start with key countries based on risks and local engagement				
Strengthen engagement with international standards	MOFCOM, CNIS	Target gaps in existing engagement on standards based on commodity risk				
Explore fiscal measures Desk research and engagement	Ministry of Finance, DRC, CASS					
Integrate supply chain sustainability into green public procurement	MOFCOM, MEP	Focus on limited number of key commodities/ products				
Develop supply chain risk criteria in existing CSR and green business guidelines	MOFCOM, SASAC, CBRC					
Make supply chains part of China's vision for sustainability	NDRC					

The International Institute for Sustainable Development has worked with the government of China since 1992 to promote policy directions that are consistent with the principles of sustainable development. IISD is committed to continuing to work in and with China to advance sustainable development, and views the area of inbound supply chains as a key strategic opportunity to achieve this mutual goal.

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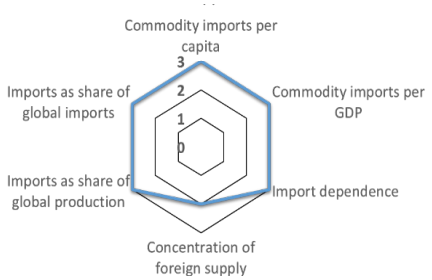
Appendix 1: Summary of Analysis: Copper

China Copper Supply Vulnerability and Economic Importance

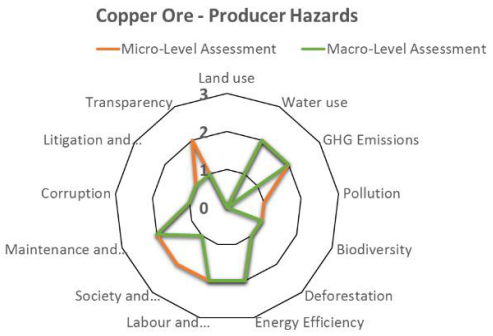


China Security of Supply -- Copper	
Copper production -- mine production (MT, 2010, BGS)	1,179,500
Copper production -- smelter production (MT, 2010, BGS)	2,825,600
Copper production -- refiner production (MT, 2010, BGS)	4,540,300
Copper production -- total (MT, 2010, BGS)	8,545,400
China exports -- matte & cement (MT, 2010, BGS)	0
China exports -- ores & concentrates (MT, 2010, BGS)	187
China exports -- scrap (MT, 2010, BGS)	2,264
China exports -- unwrought alloys (MT, 2010, BGS)	302
China exports -- unwrought, refined (MT, 2010, BGS)	38,730
China exports -- unwrought, unrefined (MT, 2010, BGS)	506
China exports -- total (MT, 2010, BGS)	41,989
China imports -- matte & cement (MT, 2010, BGS)	132,796
China imports -- ores & concentrates (MT, 2010, BGS)	6,144,396
China imports -- scrap (MT, 2010, BGS)	3,998,018
China imports -- unwrought alloys (MT, 2010, BGS)	53,016
China imports -- unwrought, refined (MT, 2010, BGS)	3,184,961
China imports -- unwrought, unrefined (MT, 2010, BGS)	228,279
China imports – total (MT, 2010, BGS)	13,741,466
Value of China copper imports ($USD, 2010, Index Mundi/ Comtrade)	46,124,156,424
Net commodity imports (MT, 2010, BGS)	13,699,477
Ratio of domestic annual mine copper production to reserves (MT, 2010, BGS)	4%
Five year increase in domestic annual mine production of copper (2006-2011), BGS)	46%
Import dependency ratio (2010)	68%
Copper stockpiles (MT, 2010)	1,900,000
Ratio of total commodity import as share of global production (2010)	28%
Ratio of total commodity import as share of global imports (2010)	37%
Ratio of value of commodity imports to GDP (2010)	0.84%
Ratio of commodity imports per capita (MT, 2010)	0.010
Ratio of value of commodity imports per capita ($USD, 2010)	34.42
Volume of copper in reserves (MT, 2012, USGS)	30,000,000
Percentage of imports coming from weak governance zones (Countries with Transparency International 2012 corruption index below 30: Top 3 – Russia, Pakistan, Venezuela)	1%
Percentage of imports coming from the three largest supplier countries	45%

	Economic Importance		Vulnerability			
Aggregate Domestic National Vulnerability and Economic Importance Score	Commodity imports per capita	Commodity imports per GDP	Import dependence	Concentration of foreign supply	Imports as share of global production	Imports as share of global imports
Very High (3)	Very High (3)	Very High (3)	Very High (3)	High (2)	Very High (3)	Very High (3)

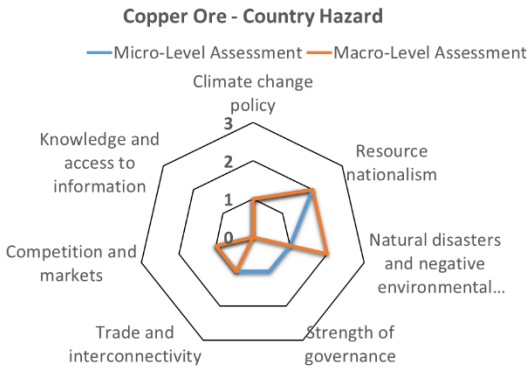
Source: Compiled from British Geological Survey (2013), Index Mundi (2013a), Bloomberg (2011), United States Geological Survey (2013), and UNSD/DESA (2013)

Copper Producer Sustainability Issues Assessment



	Fixed analysis		Micro-level assessment			Macro-level assessment		
	Relevance to the sector	Share of supply	Hazard loss exposure	Prospective Impact	Likelihood	Hazard loss exposure	Prospective Impact	Likelihood
Aggregate Producer Supply Hazards Score			**Medium (1)**			**Medium (1)**		
	• Energy efficiency, greenhouse gas emissions, biodiversity, labour and human rights, society and community, maintenance and safety, and transparency are the highest-ranking hazards.							
Land use	Low (0)	Low (0)	**Low (0)**	Medium (1)	Low (0)	**Low (0)**	Low (0)	Low (0)
	• Land use, in terms of the land area being used for copper mining, is typically small relative to agriculture. In Australia, for example, mining sites disturb approximately 0.25 per cent of landmass (Minerals Council, 2010). In Peru, 12 per cent of total land is under mining concessions, but only 0.08 per cent of total land area is being mined (Salazar, 2010). • The likelihood of impact of land use from copper mining on Chinese enterprises is minimal at present, but can become a problem in the future with the continued expansion of copper mining in key countries like Peru and Chile. • Land rights, however, can be a significant concern (covered under Human Rights and Community and Society hazards).							
Water use	High (2)	Medium (1)	**High (2)**	High (2)	Medium (1)	**High (2)**	High (2)	Medium (1)
	• Water use by copper mining companies can lead to conflicts with agricultural users, relating to the total amount of water being used and changes in the quality of the water, especially in areas that are already water stressed. • Lack of water availability can decrease mining productivity and/or increase costs (ICMM, 2012). Water is required in hydrometallurgical processes (to retrieve copper from a solution of chemicals) and pyrometallurgical processes (for cooling and other parts of mineral processing).							
GHG emissions	Very High (3)	High (2)	**High (2)**	High (2)	Medium (1)	**High (2)**	High (2)	Medium (1)
	• In Chile, it is estimated that expanding copper production 37 per cent between 2009 and 2020 will double annual greenhouse gas emissions from 18 million to 36 million MT (Baete, 2009). In Australia, it is estimated that 15 MT of carbon emissions are produced for every metric tonne of copper (Mudd et al., 2012). • The greenhouse gas intensity of copper can become a supply hazard to Chinese enterprises if these environmental costs are reflected in the price of copper, or by brand and reputational effects from public concerns.							
Pollution	Medium (1)	High (2)	**Medium (1)**	Medium (1)	Low (0)	**Low (0)**	Low (0)	Low (0)
	• Water pollution from copper mining operations is a significant concern, and occurs when there is the dissolution and transportation of metals and heavy metals by runoff and groundwater if proper protective measures are not taken (USEPA, 1995). • Some chemicals like arsenic, sulphuric acid and mercury can also accumulate in unusually high concentrations due to copper production.							
Biodiversity	High (2)	Medium (1)	**Medium (1)**	High (2)	Low (0)	**Medium (1)**	Medium (1)	Medium (1)
	• Many copper deposits are located in ecologically sensitive areas, including the location of many mining sites in Peru, Madagascar and Indonesia (ICMM, 2010). Mining companies need to be very strategic when deciding whether and how to exploit areas that are rich in biodiversity (Rio Tinto, 2008). Any severe demarcation from local and global expectations of appropriate mining behaviour could severely damage their social license to operate, leading to a reduction in its opportunity set and increased costs (Miningfacts, 2012).							
Deforestation	Medium (1)	Low (0)	**Medium (1)**	High (2)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• Although mining does not cause deforestation on the same scale as logging and agriculture, it can be a significant concern at a select number of sites. In Brazil's Carajas Mineral Province, which may be the world's largest copper reserves, wood is being cut for charcoal to fuel pig iron plants, resulting in annual deforestation of 6,100 square kilometres (WWF Global, n.d.a).							
Energy Efficiency	Very High (3)	High (2)	**High (2)**	Medium (1)	Very High (3)	**High (2)**	High (2)	Medium (1)
	• The energy used to produce metals is expected to approach 40 per cent of global energy supply by 2050, and copper will be an important part of this energy consumption (MacLean, et al., 2010). • Currently, energy costs can represent 15 per cent of a mining companies' cost of production, while they represent 20–40 per cent of production costs in the metals industry (Accenture, 2012).							
Labour and Human Rights	High (2)	Medium (1)	**High (2)**	High (2)	Medium (1)	**High (2)**	High (2)	Medium (1)
	• Some mining sites have been accused of using child labour and denying workers' right to organize. In a 122-page report by Human Rights Watch, Chining copper mining companies in Zambia are accused of significant human rights abuses (Human Rights Watch, 2011). These claimed abuses were covered across various media outlets including the BBC (2011), the *Guardian* (Smith, 2011) and *TIME Magazine* (Tharoor, 2011).							
Society and Communities	High (2)	High (2)	**High (2)**	High (2)	Medium (1)	**Medium (1)**	Medium (1)	Medium (1)
	• Various competing claims over land use and land rights can lead to conflicts when mining companies displace agriculture, livestock farming or other traditional land users (Apoyo Consultoria, 2009). These conflicts can lead to damages to equipment, and disruptions to operations. • Community consultation and early engagement can help establish good relationships between government, mining companies and local communities (ICMM, 2013). Such an approach is especially important in countries with a history of colonialism, or where there is already a distrust of government or other groups in society. If local communities perceive that projects have been imposed on them without sufficient consultation, there may be significant opposition to mining operations (Clark & Clark, 1999).							
Maintenance and Safety	Very High (3)	Medium (1)	**High (2)**	Very High (3)	Medium (1)	**High (2)**	High (2)	Medium (1)
	• Maintenance and safety is especially important for the mining sector. Mining accidents, although they rarely occur, are high impact events with significant human, productivity and financial consequences. Mining collapse, explosions and machinery accidents are significant causes of fatalities and operation disruptions. Corporate leadership is necessary to help minimize these risks (ICMM, n.d.a; ICMM n.d.b). • In Chile, an average of 34 people have died annually in mining accidents since 2000, with a high of 43 fatalities in 2008 (Long, 2010). The 2010 Copiago mining accident that trapped 33 gold-copper miners underground for 69 days was allegedly the result of managerial negligence (Govan, Laing & Allen, 2010) and the mine is now considering bankruptcy and has remained closed in the aftermath of this incident (Agencia Venezolana de Noticias, 2010).							
Corruption	High (2)	Medium (1)	**Medium (1)**	High (2)	Low (0)	**Medium (1)**	High (2)	Medium (1)
	• Processes for awarding mining rights to companies are often mired in corruption. As a result, many mineral rich countries are stuck in poverty because public revenues that would have otherwise been gained from selling these resources are squandered through corrupt practices or lack of government accountability (Global Witness, n.d.). • When corrupt practices are uncovered, these can reduce the producer's ability to access new projects, and can result in class action suits that reduce its financial return to investors.							
Litigation and Compliance Risks	High (2)	Low (0)	**Medium (1)**	High (2)	Medium (1)	**Medium (1)**	Medium (1)	Medium (1)
	• Mining companies often operate in areas with lax regulations or enforcement. However, litigation risks from negative environmental practices, human rights violations and corruption are still a concern. • Due to the strong salience of environmental practices, human rights and corruption to the mining sector, litigation and compliance risks are significant.							
Transparency	Very High (3)	High (2)	**High (2)**	Medium (1)	Medium (1)	**Medium (1)**	Low (0)	Medium (1)
	• Corporate transparency is associated with responsible business activities. The companies that are more transparent also tend to be more responsible. Therefore, transparency mitigates litigation and compliance risks as well as various irresponsible, unsustainable and illegal practices.							

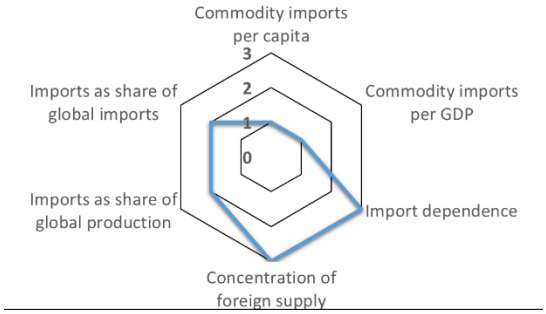
Copper Country Environment Assessment



	Fixed analysis		Micro-level assessment			Macro-level assessment		
	Relevance to the sector	**Share of supply**	**Hazard loss exposure**	**Prospective Impact**	**Likelihood**	**Hazard loss exposure**	**Prospective Impact**	**Likelihood**
Aggregate Producer Supply Hazards Score			**Medium (1)**			**Medium (1)**		
	• Both at the micro and macro levels, the aggregate hazard loss exposure is assessed to be medium. The risks of resource nationalism and natural disasters and environmental degradation are most relevant at both levels. Enterprise level risks are believed to be marginally smaller because of the possibility of substituting one supplier country for another, a luxury not enjoyed at the national level.							
Climate change policy	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• Australia's recent decision to abolish its carbon tax has made it seem relatively less progressive on climate policy; the decision has been unpopular, and regional partners have taken notice (Radio Australia, 2013). Further, Germanwatch and the Climate Action Network's Climate Change Performance Index (CCPI) rates the country's emissions profile development, renewable energy policy, energy efficiency and especially its emissions level as poor (Germanwatch, 2013). • This hazard is pronounced only for Australia (Chile and Peru's climate policies are rated more favourably), and with copper production being less associated with carbon emissions than other more carbon intensive sectors such as energy production, the loss exposure is believed to be low (at present) at both macro and micro levels.							
Resource nationalism	Very high (3)	Very high (3)	**High (2)**	Medium (1)	Medium (1)	**High (2)**	High (2)	Medium (1)
	• Maplecroft's Resource Nationalism Index (RNI) investigates factors such as risk of outright nationalization and expropriation, export freezes or restrictions, and increases in taxes on revenues and places the risk associated with resource nationalism at medium for Chile, Peru and Australia, noting Australia's Mineral Resources Rent Tax (Maplecroft, 2012). • Supply restrictions associated with resource nationalism are more pronounced at the macro level, since the potential for using new suppliers is greater for individual firms; whereas at the country level substitution is more difficult.							
Natural disasters and negative environmental events	Medium (1)	High (2)	**Medium (1)**	Low (0)	High (2)	**High (2)**	Medium (1)	High (2)
	• Chile is assessed to be highly risk exposed with respect to natural disasters and environmental degradation because of its high degree of exposure; however, this is counter-balanced with a relatively low vulnerability with respect to coping and adaptive capacities. Peru is assessed as having a medium degree of risk on the same scale; less exposed than Chile, but more vulnerable (Alliance Development, 2012). • Natural disasters and environmental factors would affect supply lines and infrastructure but wouldn't affect production as directly as, for example, agricultural commodities.							
Strength of governance	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)	**Low (0)**	Low (0)	Low (0)
	• Peru presents governance-associated risks, particularly with respect to political stability, government effectiveness, rule of law, and corruption (World Bank, 2013). • The risk associated with sourcing copper from nations with poor governance records is more strongly impacted by high-profile events such as human rights abuses, which are less likely for Peru since the country scores relatively well on voice and accountability dimensions of governance.							
Trade and interconnectivity	Very high (3)	Low (0)	**Medium (1)**	High (2)	Low (0)	**Medium (1)**	High (2)	Low (0)
	• All main supplier nations were found in the International Chamber of Commerce's Open Markets Index (2013) were found to have average levels of trade openness, and scored favourably with respect to their trade policy and trade-enabling.							
Competition and markets	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• All main supplier nations are found to be stable or favourable with respect to their competiveness. Australia is regarded as having efficient, competitive markets; Chile has well-functioning markets with high levels of domestic competition; and Peru, although facing challenges with respect to innovation and skills gaps, has been moving steadily up the index rankings in recent years (World Economic Forum).							
Knowledge and access to information	Low (0)	Low (0)	**Low (0)**	Low (0)	Low (0)	**Low (0)**	Low (0)	Low (0)
	• All three main supplier countries are relatively well developed, with strong Internet penetration and intergration into global institutions and networks. Access to information is not believed to be an issue. • Although Peru has challenges with respect to its education sector, its mining sector is well developed and is able to attract the human capital it requires.							

Appendix 2: Summary of Analysis: Palm oil

China Palm Oil Supply Vulnerability and Economic Importance

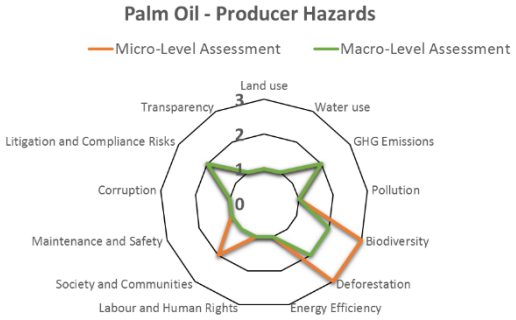


China Security of Supply – Palm Oil	
Palm oil production (MT, 2009 FAOSTAT)	230,000
Palm oil exports (MT, 2009 FAOSTAT)	64,124
Palm oil imports (MT, 2009 FAOSTAT)	6,866,801
Palm oil import value (1,000 $USD, 2009 FAOSTAT)	4,339,937
Net commodity imports (MT, 2009 FAOSTAT)	6,802,677
Palm oil domestic supply (MT, 2009 FAOSTAT)	7,032,877
Import dependency ratio (MT, 2009 FAOSTAT)	98%
Ratio of total palm oil import as share of global production (2009)	16%
Ratio of total palm oil import as share of global imports (2009)	20%
Ratio of value of palm oil imports to GDP (2009)	0.09%
Ratio of palm oil imports per capita (2009)	0.005
Ratio of value of palm oil imports per capita ($USD, 2009)	3.26
Volume of palm oil in reserves (MT, 2009 FAOSTAT)	200
Percentage of palm oil imports coming from weak governance zones (Countries with Transparency International 2012 corruption index below 30)(2009)	0%
Percentage of palm oil imports coming from zones with high or extreme geopolitical risk [Countries with Maplecroft Political Risk (Dynamic)2013 Index below 3.75] (2009)	37%
Percentage of imports coming from the three largest supplier countries (Malaysia, Indonesia, India)(2009)	96%
Percentage of cash spent on food (urban population)(2011)	36%
Percentage of consumption spending on food (rural population)(2011)	40-45%

	Economic Importance		Vulnerability			
Aggregate Domestic National Vulnerability and Economic Importance Score	**Commodity imports per capita**	**Commodity imports per GDP**	**Import dependence**	**Concentration of foreign supply**	**Imports as share of global production**	**Imports as share of global imports**
High (2)	Medium (1)	Medium (1)	Very High (3)	Very High (3)	High (2)	High (2)

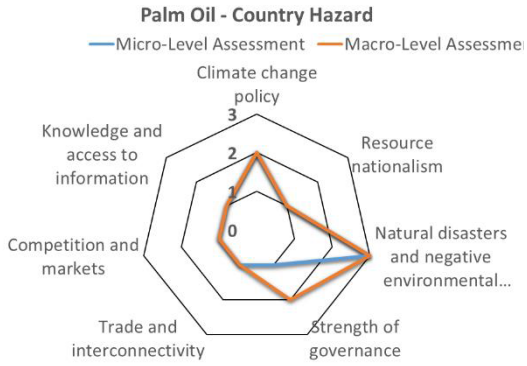
Source: Compiled from FAOSTAT (2013) and Kreab Gavin Anderson (2013).

Palm Oil Producer Sustainability Issues Assessment



	Fixed analysis		Micro-level assessment			Macro-level assessment		
	Relevance to the sector	Share of supply	Hazard loss exposure	Prospective Impact	Likelihood	Hazard loss exposure	Prospective Impact	Likelihood
Aggregate Producer Supply Hazards Score			**High (2)**			**Medium (1)**		
Land use	Medium (1)	High (2)	**Medium (1)**	Medium (1)	Medium (1)	**Medium (1)**	Medium (1)	Medium (1)
	• Palm oil is the subject of the food-versus-fuel debate, which draws attention to the issue that the expansion of oil palms for biofuel production has direct and indirect effects on food security. Because palm oil is being bought for biofuel production instead of food, there is increasing demand for the commodity, and thus an increase in prices for palm oil destined for food. Additionally, oil palm expansion has serious environmental effects (covered in greenhouse gas emissions and deforestation hazards), and also diverts agricultural land away from growing crops for food use. However, palm oil can also be cultivated on degraded land that is unsuitable to other crops.							
Water use	Low (0)	Medium (1)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• Oil palm plantations in Asia are rainfed due to the heavy to moderate rainfalls in Malaysia and Indonesia. However, some irrigation has been shown to increase yields during periodic droughts (Ludwig, Biemans, Jacobs, Supit, van Diepen &Fawell, 2011). Although droughts are low frequency events in Malaysia and Indonesia, they can have an impact on palm oil production.							
GHG Emissions	Very High (3)	High (2)	**High (2)**	High (2)	High (2)	**High (2)**	High (2)	Medium (1)
	• Greenhouse gas emissions from palm oil production range from 4,000 to 30,000 megatonnes per 1 megatonne of palm oil (Brinkmann, 2009). The main causes of these emissions are the slash-and-burn practices that are used to clear the rainforest for oil palm plantations (Brinkmann, 2009). • It is estimated that Indonesia's palm oil industry alone could generate as much as 558 million megatonnes of carbon by 2020, an amount that exceeds the national emissions of Canada (Massey, 2012). Despite being a small country, Indonesia is the world's third largest emitter of greenhouse gases (Foster, 2012).							
Pollution	Medium (1)	High (2)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• Although standard nutrients like nitrogen, phosphorous and potassium are applied regularly to oil palm trees, palm oil production requires less fertilizer per unit of output than any other oilseed crop (WWF Global, n.d.b). Because oil palm trees, when fully grown, produce a thick canopy that shades the ground, the use of herbicides is greatly reduced. The main pesticide used on plantations is poison to control rats, the Oryctes rhinoceros beetle, Ganoderma, stem rot and other beetles and bagworms. Some herbicides are used, particularly when plantations are being established. • For every tonne of palm oil produced, 2.5 tonnes of effluent are generated, with an average biochemical oxygen demand (BOD) of 25,000 parts per million (WWF Global, n.d.c) In Malaysia, the BOD level must be below 100 parts per million before effluent can be legally discharged into streams (WWF Global, n.d.c).							
Biodiversity	Very High (3)	Very High (3)	Very High (3)	Very High (3)	Medium (1)	**High (2)**	High (2)	Medium (1)
	• Oil palm plantations are located in some of the most biodiverse locations in the world, and have been blamed for playing a leading role in the destruction of vast areas of rich tropical forest (ZSL, n.d.). Indonesia's forests are home to a rich variety of species, including the Sumatran tiger and the rhinoceros hornbill, which are unique to the country (ZSL, n.d.). Whereas nearly 80 mammal species are found in Malaysia's primary forests, disturbed forests have just over 30 mammal species, while oil palm plantations have only 11 or 12 (WWF Global, n.d.d). Most of these species cannot survive in oil palm monocultures, and the expansion of the crop is leading to increasing frequency of human wildlife conflicts. Elephants and orangutans are considered pests as they eat oil palm fronds and seeds, and are often killed (WWF Global, n.d.d).							
Deforestation	Very High (3)	High (2)	Very High (3)	Very High (3)	High (2)	**High (2)**	High (2)	Medium (1)
	• Oil palm expansion has been credited with wide deforestation of tropical forest in Malaysia and Indonesia. It is estimated that about 10 million of Indonesia's 22.5 million hectares of peatland have been deforested and drained, and a large portion of this deforestation occurred to make way for oil palms (Greenpeace, n.d). With the forecasted expansion of palm oil by approximately 30 per cent in both countries by 2020, deforestation is a major issue.							
Energy Efficiency	Low (0)	Medium (1)	**Medium (1)**	Low (0)	High (2)	**Medium (1)**	Low (0)	Medium (1)
	• The agricultural production, harvesting and processing of palm oil fruits is not particularly energy intensive. Setting aside the various environmental and social impacts of producing palm oil for energy use, the crop can also improve energy supply.							
Labour and Human Rights	High (2)	Low (0)	**Medium (1)**	Medium (1)	Medium (1)	**Medium (1)**	Low (0)	Low (0)
	• A nine-month investigation at 12 oil palm plantations in Borneo and Sumatra, where 96 per cent of Indonesia's palm oil operations are located, revealed human rights abuses (Skinner, 2013). Among the estimated 3.7 million workers in Indonesia's palm oil industry, it was estimated that there are thousands of child labourers and workers facing abusive conditions, including debt bondage (Skinner, 2013). In Malaysia, according to the U.S. Department of Labour, palm oil is produced with forced labour (Verité, n.d.). In 2010, Sawit Watch recorded the following labor abuses in Indonesia: physical abuse, intimidations, unpaid wages and unpaid overtime, indebtedness, child labour, lack of employment contracts, unsatisfactory living conditions, and dangerous working conditions, including unprotected work with chemicals (Verité, n.d.). In addition, many of the areas where palm oil plantations are established have traditionally been inhabited by indigenous communities, raising concerns relating to the rights of indigenous peoples regarding their rights to land and land use (Chao, 2012).							
Society and Communities	High (2)	Low (0)	**High (2)**	High (2)	Medium (1)	**Medium (1)**	Medium (1)	Low (1)
	• Where carried out community consultations by palm oil companies tend to be one-offs, rather than iterative processes of dialogue, discussion and negotiation (Colchester & Chao, 2013). Communities tend to not be given sufficient time to make collective decisions regarding a company's operations, and companies typically work through the local government instead. Due to lack of respect for the customary land rights of local communities, land conflicts are ongoing in most plantations, to varying degrees ranging from minor disputes over land to village-wide protests, demonstrations, blockades and protracted court cases (Colchester & Chao, 2013).							
Maintenance and Safety	Medium (1)	High (2)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Low (0)	Low (0)
	• The major safety hazards in oil palm plantations include falling from trees, injuries from cutting wood or due to contact with palm oil fruit and thorns, being hit by falling fruit bunches, poisoning from agricultural chemicals and the long-term health effects from pesticide use or exposure (ILO, 2004).							
Corruption	Medium (1)	High (2)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Low (0)	Low (0)
	• Palm oil companies typically do not consult local communities sufficiently, and tend to work through the government or the heads of communities, which are also prone to corrupt practices (Colchester & Chao, 2013).							
Litigation and Compliance Risks	Very High (3)	High (2)	**High (2)**	Medium (1)	Medium (1)	**High (2)**	Medium (1)	Medium (1)
	• Between May and September 2013, widespread wildfires were claimed to have been set deliberately to clear land for new palm oil plantations in Indonesia, a practice that is illegal (NASA, 2013). • Ghost palm oil estates which operate without the necessary permits are also a problem. One of the largest owners of palm oil plantations, Burmitama Agri Ltd., which controls 200,000 hectares of plantation has recently been blamed for taking part in illegal clearing of hundreds of hectares of peatland and forest in clear violation of national laws (FOE Europe, 2013). At least 7,000 hectares of ghost estates have also been found in Burmitama's land bank (FOE Europe, 2013).							
Transparency	High (2)	Medium (1)	**Medium (1)**	Medium (1)	Medium (1)	**Medium (1)**	Medium (1)	Medium (1)
	• Corporate transparency is associated with responsible business activities. The companies that are more transparent also tend to be more responsible. Therefore, transparency mitigates litigation and compliance risks as well as various irresponsible, unsustainable and illegal practices.							

Palm oil Country Environment Assessment



	Fixed analysis		Micro-level assessment			Macro-level assessment		
	Relevance to the sector	Share of supply	Hazard loss exposure	Prospective Impact	Likelihood	Hazard loss exposure	Prospective Impact	Likelihood
Aggregate Producer Supply Hazards Score			**Medium (1)**			**High (2)**		
	• Risks related to climate policy, resource nationalism and natural disasters and negative environmental events are pronounced for the sector. Individual firms' ability to shift suppliers places their individual level of risk exposure at medium, but since this is less of a possibility at the national level, the risk is assessed as being high at this level.							
Climate change policy	Very high (3)	Very high (3)	**High (2)**	High (2)	Medium (1)	**High (2)**	Medium (1)	Medium (1)
	• Germanwatch and the Climate Action Network's Climate Change Performance Index (CCPI) rates Indonesia and Malaysia's present level of emissions very favourably, but highlights a very poor record with respect to pending emissions profile development, and the country's energy efficiency and climate policy are rated as poor (Germanwatch, 2013). • India is assessed more favourably, for reasons similar to those above, but with the exception of a relatively more favourable assessment of its climate policy; overall the country's CCPI score is assessed as being moderate. • Land use and land change associated with the palm oil sector can have strong impacts on emissions, therefore supplier country's climate policy is highly relevant to the sector.							
Resource nationalism	Medium (1)	Medium (1)	**Medium (1)**	High (2)	Low (0)	**Medium (1)**	High (2)	Low (0)
	• Maplecroft's Resource Nationalism Index (RNI) investigates factors such as risk of outright nationalization and expropriation, export freezes or restrictions, and increases in taxes on revenues and places the risk associated with resource nationalism at high risk for Indonesia, and moderate risk for Malaysia and India (Maplecroft, 2012). • Supply restrictions associated with resource nationalism are less of a factor for agricultural commodities than for minerals. Nevertheless, the possibility exists for nationalization processes to occur with respect to agricultural land and forest land that might otherwise be converted to palm oil production.							
Natural disasters and negative environmental events	Very high (3)	Very high (3)	**Very High (3)**	Very high (3)	Medium (1)	**Very High (3)**	Very high(3)	Medium (1)
	• Indonesia is assessed to be highly risk exposed with respect to natural disasters and environmental degradation because of its very high degree of exposure combined with its high degree of vulnerability with respect to coping and adaptive capacities, Malaysia and India are assessed to have a moderate level of risk because of high exposure and low vulnerability in the case of Malaysia, and low moderate exposure and high vulnerability in India (Alliance, 2012). • Natural disasters and environmental factors have a strong possibility of negatively impacting agricultural production, especially monocrop agriculture, which is prominent in palm oil production.							
Strength of governance	High (2)	High (2)	**Medium (1)**	Medium (1)	Low (0)	**High (2)**	High (2)	Low (0)
	• Indonesia and India present governance-associated risks with regard to government effectiveness, regulatory quality, rule of law, corruption and political stability, particularly in India (World Bank, 2013). • Malaysia is assessed more favourably with regard to governance related risks, with the exception of voice and accountability, an area where India and Indonesia score comparatively well. • Poverty is an issue in India and also in Indonesia, and poor governance could conceivably lead to major impacts on the agricultural sector given the food insecurity these countries face. These impacts could affect palm oil supplies. • Individual enterprises could cope with these changes by changing their supply mix, but this is less possible at the national level.							
Trade and interconnectivity	Low (0)	High (2)	**Medium (1)**	High (2)	Low (0)	**Medium (1)**	High (2)	Low (0)
	• India was found in the International Chamber of Commerce's Open Markets Index (2013) to have below average levels of trade openness, the lowest of the G20; Malaysia and Indonesia (the largest supplier countries) were both found to be average. Malaysia was at the higher end, with more favourable openness and strong infrastructure, while Indonesia was found to be less open, and to have relatively weak trade related infrastructure. • Palm oil is an export crop for the supplier countries and is less likely than some other commodities to be consumed domestically; therefore although supplier nations' trade openness is a factor, so long as policies more or less adhere with international norms, the risk of trade policy related disruptions is minimal.							
Competition and markets	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• Malaysia and Indonesia, the two biggest suppliers, score well on the World Economic Forum's Global Competitiveness Index (2013). Malaysia scores tenth place with respect to its efficient and competitive market for goods and services, and also scores well with respect to its business related institutional framework. Indonesia score less well than Malaysia, but has made improvements with respect to infrastructure and its labour market. • India has been falling in its position in the index in recent years, currently at 60th place, largely due to infrastructure challenges, which along with corruption are a major impediment to doing business in the country. The lack of business sector reforms is also an issue.							
Knowledge and access to information	High (2)	Low (0)	**Medium (1)**	Medium (1)	Low (0)	**Medium (1)**	Medium (1)	Low (0)
	• All supplier countries are relatively well positioned in terms of knowledge and access to information. Although knowledge and access may not have trickled down to all members of society, Malaysia and India possess high levels of human capital in certain technology sectors, and Indonesia's technological readiness in the private sector has been improving in recent years (World Economic Forum, 2013). • Palm oil production occurs largely on large plantations rather than through smallholders, therefore the risks associated with poor access to information and knowledge are less pronounced, since these plantations likely have little trouble securing relevant information related to production and trade.							

Appendix 3: Key Data Sources: Country environment

	RISKS	SOURCES
Climate change policy	Failure to address international competitiveness risks to its emissions profile	Government policy Germanwatch and the Climate Action Network's Climate Change Performance Index
Resource nationalization	Risk of nationalization and expropriation, export freezes or restrictions, and increases in taxes on revenues	Maplecroft Resource Nationalism index
Natural disasters and negative environmental events	Risks of natural hazards: earthquakes, floods, storms, sea level rise Lack of adaptive capacity	Alliance Development Works. (2012). *Risk Report 2012 – Focus: Environmental degradation and disasters.* Available at: http://www.ehs.unu.edu/file/get/10487.pdf
Open markets	Risk of lack of trade openness	International Chamber of Commerce. (2013). *Open Markets Index*. Available at: http://www.iccwbo.org/Global-influence/G20/Reports-and-Products/Open-Markets-Index/
Governance	Risks related to government effectiveness, regulatory quality, rule of law, corruption and political stability, lack of voice and accountability.	World Bank. (2013). *Worldwide Governance Indicators.* Available at: http://info.worldbank.org/governance/wgi/index.asp
Competition and markets	Intensity of competition and adequacy of market plumbing and housekeeping	World Economic Forum. (2013). The Global Competitiveness Report 2013–2014. Available at: http://reports.weforum.org/the-global-competitiveness-report-2013-2014/#=
Knowledge and access to information	Risk of lack of adequate information by producers	World Economic Forum. (2013). The Global Competitiveness Report 2013–2014. Available at: http://reports.weforum.org/the-global-competitiveness-report-2013-2014/#=

Appendix 4: Potential additional indicators

		Macro level (country)	Micro level (enterprise)
Domestic (Demand-side)	Economic importance	**Existing indicators:** • Commodity imports per capita • Commodity imports per GDP **Potential additional indicators:** • Direct employment in key commodity consuming sectors • Induced employment in key commodity consuming sectors • Technical expertise in key commodity consuming sectors (number of engineers or energy employees) • Unemployment in these sectors (%) • Expenditures on financial support mechanisms to these sectors • Net capital investment in related infrastructure • Total amount of stranded costs or sunk costs • Planned production expansion in these sectors • Average rate of return on investments in these sectors • Commodity intensity (amount needed for USD $1,000 of GDP) • Commodity intensity in key sectors (amount needed for USD $1,000 of GDP in key sectors)	**(Existing: none used, currently relies on macro indicators)** **Potential additional indicators:** • Commodity importance to product value • Investment and Employment • Efficiency and Intensity • Innovation and Research • Supply chain integration • Ownership of commodity supply base • Planned new key commodity consuming sector projects including construction status of approved projects • Commodity intensity (amount needed for USD $1,000 of EBITDA) • Commodity intensity in key sectors (amount needed for USD $1,000 of EBITDA)
	Vulnerability	**Existing indicators:** • Imports as share of global production • Imports as share of global imports • Import dependence • Concentration of foreign supply Diversification **Potential additional indicators:** • Total commodity reserves • Total commodity reserves per capita • Proven recoverable commodity reserves • Proven recoverable commodity reserves per capita • Average commodity reserve-to-production ratio • Average commodity reserve-to-consumption ratio • Self-sufficiency (percentage of demand met by domestic production) • Total commodity supply per capita • Total commodity supply per GDP • Peak commodity demand (eg. peak load electricity demand) • Base commodity demand (eg. base load electricity demand) • Refining capacity (as percentage of consumption) • Refining capacity (volume refined per year) • Annual amount of commodity production • Growth in commodity production per year • Annual commodity consumption per capita • Net commodity imports • Ratio of commodity exports and imports to consumption • Total commodity imports • Balance of payments related to commodity or commodity group imports • Diversification in commodity sourcing (number of countries, companies, etc.) • ShannoneWiener Index • Herfindahl-Hirschman Index (HHI) Index • Commodity capacity margins (maximum supply versus maximum demand) • Volume of commodity in reserves • percentage of commodity capacity actually utilized • Peak demand vs. base demand (eg. baseload demand) ratio • Consumption profiles summer/ winter • Production profiles summer/ winter • Emergency stockpiles (number of days to meet average demand) • Emergency stockpiles (as % of imports)	**(Existing: none used, currently relies on macro indicators)** **Potential additional indicators:** • Total number of suppliers • percentage of sourcing from 3 biggest external suppliers • Turnover of suppliers in per cent • ESG compliance systems • Cost of interruptions
Foreign (Supply-side)	Producer sustainability	**Existing indicators:** • Level of land use • Level of water use • GHG intensity • Pollution concerns • Biodiversity impacts • Energy intensity • Labour and human rights concerns • Concerns in relation to competing claims on resources • Safety risks • Corruption concerns in relation to the industry • Litigation and compliance risks in the industry • Concern over lack of transparency **Potential additional indicators:** • New issues	**Existing indicators:** • Level of land use • Level of water use • GHG intensity • Pollution concerns • Biodiversity impacts • Energy intensity • Labour and human rights concerns • Concerns in relation to competing claims on resources • Safety risks • Corruption concerns in relation to the industry • Litigation and compliance risks in the industry • Concern over lack of transparency **Potential additional indicators:** • New issues
	Country environment	**Existing indicators:** • Lack of strong climate policy • Resource nationalism • Exposure to natural hazards • Lack of commitment to trade openness • Poor record on governance • Poor rating on market competition and infrastructure • Risk of lack of adequate information by producers **Potential additional indicators:** • New issues	**Existing indicators:** • Lack of strong climate policy • Resource nationalism • Exposure to natural hazards • Lack of commitment to trade openness • Poor record on governance • Poor rating on market competition and infrastructure • Risk of lack of adequate information by producers **Potential additional indicators:** • New issues

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