



**China Council for International Cooperation on Environment and
Development (CCICED) Special Policy Study**

Global Green Value Chains:

**China's Opportunities, Challenges and Paths in the Current Economic
Context**

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Table of Contents

Executive Summary	vi
1. Introduction.....	1
1.1. Research Background	1
1.2. Review of Outcomes of the Phase 1 Special Policy Study	2
1.3. Opportunities related to Green Value Chains in China in the Current Economic Context	3
1.4. Challenges to achieving Green Value Chains in China.....	5
1.5. Main Research Topics.....	6
2. Greening the Production and Sourcing of Soft Commodities.....	7
2.1. Emerging Norms for Legality, Sustainability and Traceability in Soft Commodity Value Chains	7
2.1.1 Regulations and public policy.....	7
2.1.2 Voluntary private sector norms and best practice.....	11
2.1.3 Finance sector norms and best practice	12
2.1.4 Trade norms	13
2.2. Due Diligence and Traceability Measures for Soft Commodities	15
2.2.1 International experience - feasibility, practicality, costs, and strategy for developing enhanced legality due diligence and value chain traceability measures	15
2.2.2 International examples of company due diligence and traceability systems for soft commodities.....	16
2.2.3 The role of technologies in strengthening due diligence and traceability systems.....	17
2.2.4 Chinese experience of due diligence and traceability systems for commodities	20
3. Accelerating Circular Economy throughout the Value Chain	24
3.1. Why embracing circular economy is important for greening value chains?	25
3.1.1 The potential of a circular economy at global level	25
3.1.2 What is the significance of the circular economy for China?	27
3.1.3 Circular economy can make a significant contribution to China’s carbon neutrality goal. ...	27
3.1.4 Circular economy principles allow producers to contribute to China’s Dual Circulation policy while reducing pressures on nature resources.....	29
3.1.5 Circular economy practices can set the foundation for high-quality development	33
3.1.6 Circular economy can spur new business opportunities for Chinese enterprises	36
3.2. Five enablers of circular economy in China’s value chains	39
3.2.1 Circular economy design and product standards and certification systems.	39
3.2.2 Tapping into options within green finance to support circular business models.....	40
3.2.3 Utilizing the advanced technologies of the 21st century.....	41
3.2.4 Strengthening regulations and institutions within China and beyond	41
3.2.5 Developing new circular business models to support the transition.....	42
4. Policy Recommendations	44
4.1. Pursue six priorities in the new development phase for China on Green Value Chains.....	44

4.1.1	Communicate China’s intentions to develop a strategic framework for greening value chains in collaboration with international partners.....	44
4.1.2	Develop a regulatory framework for due diligence and traceability measures for soft commodities.....	45
4.1.3	Develop technologies to support due diligence and traceability	46
4.1.4	Create new financial instruments that favor green value chains	46
4.1.5	Include green value chain measures in trade agreements	47
4.1.6	Mainstream circular economy principles to support green consumption and sustainable sourcing	48
4.2.	Accelerate the Development of China's Green Value Chain Promotion Mechanism	48
4.2.1	Constitute China’s Green Value Chain Promotion Mechanism	48
4.2.2	Develop plans and priorities for the Green Value Institute	49
4.2.3	Foster research and policy dialogue to support the greening of the entire value chain.....	49
	Acknowledgements	51
	References.....	52

Figures

Figure 1. How circular economy contributes to green value chains	5
Figure 2. A growing number of countries have policies in place to support green soft commodity value chains	9
Figure 3. Technologies enable due diligence and traceability across the value chain.....	18
Figure 4. Global GHG emissions by sector - 45% can be attributed to the production of materials and management of land.....	26
Figure 5. China’s Green Value Chain Coordination Mechanism	49

Tables

Table 1. Country examples of regulatory measures and policies that support the greening of soft commodity value chains.....	9
Table 2. Comparing CO2 emission reduction potential across different materials	28
Table 3. Summary of recommendations	44

Boxes

Box 1. Definition of Key Terms	2
Box 2. Key Recommendations of the 2020 CCICED SPS on Global Green Value Chains	3
Box 3. Key takeaways – Emerging Norms for Soft Commodity Legality, Sustainability and Traceability	7
Box 4. Leading companies call for mandatory due diligence laws.....	12
Box 5. WTO’s principle of non-discriminations and GATT exceptions	14
Box 6. Types of environmental provisions in trade agreements.....	15
Box 7. Key takeaways on Due Diligence and Traceability	15
Box 8. Key takeaways – the importance of circular economy for China and greening value chains	25
Box 9. Key takeaways – Enablers of circular economy in China’s value chains	39

Executive Summary

Because they require huge volumes of raw commodities, sourced from diverse origins, global value chains can have significant negative impacts on biodiversity, climate change, ecological functions and the rights and livelihoods of communities in regions where commodities are produced. The greening of commodity value chains is an effective strategy to deal with those challenges. Green value chains offer the dual prospect of an economy that is less harmful to nature, and production, trade and consumption that is more secure and stable. More and more global value chain participants are pursuing greener value chains through responsible production and sourcing of commodities and circular economy practices to increase longevity of products, re-use of materials and minimization of waste.

China is entering a new era of development, in which it expects to progress from a well-off society to a “beautiful” and “great modern socialist country” by 2050. The 14th “Five-Year Plan” envisions a new development journey that emphasizes the quality, safety and sustainability of development over the quantity of growth. In the wake of disruption of the global economy due to the COVID-19 pandemic, China is pursuing a “dual circulation” economic framework in which domestic and international value chains are mutually reinforcing with the domestic market as the mainstay. China has also pledged to strive for the peak of CO₂ emissions by 2030 and carbon neutrality by 2060. These strategic goals elevate the need for stability and green development in value chains. Greening value chains also aligns closely with China’s “Six Stabilities and Six Securities” policy, which lists supply chain security as one of the “six guarantees” of stability. Building a green value chain will provide solutions and realistic paths to achieve the above goals.

As the world's largest exporter and second largest importer, China is at the core of global value chains. Having benefited from the historical economic growth of global value chains, China is now well-placed to play a leadership role in the greening of global value chains. To this end, in 2020, CCICED commissioned a Special Policy Study on the Greening of the Global Soft Commodity Value Chain (CCICED, 2020), which analyzed the significance and action strategies of China in greening global soft commodity value chains. This 2021 study builds on that study and should be read as a complement to the rationale for action described in the first study.

The study goes deeper on soft commodity value chains, by providing more detailed analysis of regulations and technologies to encourage due diligence and traceability, and related trade and finance measures. It explores emerging norms for legality and sustainability for soft commodity value chains and international and Chinese experience on due diligence and traceability measures including the role of technologies.

Key takeaways are:

- Major markets are developing legislation to require due diligence for legality/sustainability in soft commodity sourcing.
- Many countries that supply soft commodities have laws restricting forest conversion and degradation and tracking systems to verify commodities are produced in compliance with such laws. For commodities produced in countries with strong laws but weak governance, China can manage risks of sourcing from illegal or unsustainable sources by requiring or encouraging Chinese companies to develop and apply their own due diligence and traceability systems. In doing so, China can draw on experience gained in the timber sector through the Chinese Timber Legality Verification Scheme.
- WTO rules allow China to include measures in bilateral and multilateral trade agreements to make green soft commodity value chains. China can work with soft commodity producer countries entering such agreements to co-design related green standards and implementation mechanisms.

The study also explores how circular economy concepts can contribute to greener value chains in China, essentially by reducing demand for raw materials, and their associated environmental impacts in producer countries, through increased reuse and recycling of products and reduced consumption and food waste in China. The focus is on apparel, food, timber and plastics because of their large climate impacts and the immense volumes of waste and pollution associated with these sectors. Additionally, apparel, food and timber have direct links to soft commodity value chains. Key takeaways are:

- Circular economy practices will be needed to reduce pressure on upstream soft commodity production by cutting raw material inputs in production through reduce, reuse and recycle (the 3Rs). These practices offer the added benefit of significant emissions reduction to contribute towards China's carbon neutral commitment.
- Circular economy approaches are consistent with reaching sustainable development goals within planetary boundaries and are a catalyst to innovation that presents business opportunities and competitive advantages for countries and for businesses that embrace it. Such approaches include promoting green consumption and lifestyles, sustainable procurement, product sharing platforms, products as a service and secondary markets.
- Of the 3Rs, reduce is the most impactful, followed by reuse and then recycle. Reduce starts with influencing customs and habits. This aligns well with Chinese holistic approaches and with the aspiration of ecological civilization. However, innovative policy and financial instruments are needed to accelerate the social transition by influencing, regulating, and incentivizing the uptake of more sustainable practices at scale.
- Circular economy practices are prevailing in major developed countries at the consumption end of global value chains. As the world largest exporter, there is a big global trade opportunity for China, but one that needs to be nurtured and supported by policy. Chinese policymakers must stay open-minded to constantly update policies to track and where relevant, lead global circular economy trends and by drawing on international experiences.

The study concludes with recommended measures to support green value chain strategies in China. These measures could help China realize the new development patterns envisaged in the 14th Five-Year Plan, the "dual circulation" strategy, and the goals of peaking carbon emissions by 2030 and reaching carbon neutrality by 2060. The study recommends that China seize the historical opportunity to speed up its greening of global value chains by taking the following actions:

- Adopt regulations requiring due diligence in soft commodity value chains, develop green finance measures, leverage technological advancement related to traceability, and utilize trade policies to support green value chains and promote the overall green transformation of economy and society.
- Promote circular economy, as an integral part of green value chains, through a combination of higher product standards, green finance, advanced technology, strengthened regulation and new business models.
- Accelerate the establishment of a green value chain promotion mechanism incorporating circular economy principles, and a technical support system to facilitate these priority actions.

Detailed recommendations are made on how China can:

- Communicate its intentions to develop a strategic framework for greening value chains in collaboration with international partners.
- Develop a regulatory framework for due diligence and traceability measures for soft commodities.
- Develop technologies to support due diligence and traceability.

- Create new financial instruments that favor green value chains.
- Include green value chain measures in trade agreements.
- Mainstream circular economy principles to support green consumption and sustainable sourcing.

Finally, recommendations are provided on the design and implementation of a mechanism to promote green value chains in China with the technical support of a "Global Green Value Chain Institute" overseen by an inter-ministerial level coordination committee. They include a proposal for the institute to support the development of a five-year plan and roadmap for China's green value chain development and to begin fostering relevant research and policy dialogues.

1. Introduction

1.1. Research Background

The term “Global Value Chains” refers to the processes by which value is added across different stages from production to consumption and carried out by actors located in different parts of the world (CCICED, 2016). In the global value chain, the production process is divided and distributed into different countries, with different companies undertaking their own specific tasks. Global value chains have significant advantages in many aspects, but their impacts on the environment cannot be ignored. Because they require huge volumes of raw commodities, sourced from diverse origins, global value chains can have significant negative impacts on biodiversity, climate change, ecological functions and the rights and livelihoods of communities in regions where commodities are produced. The greening of the commodity value chain is an effective strategy to deal with those challenges. Green value chains offer the dual prospect of an economy that is less harmful to nature, and production, trade and consumption that is more secure and stable (CCICED, 2020). More and more global value chain participants are pursuing greener value chains through responsible production and sourcing of commodities and circular economy practices to increase longevity of products, re-use of materials and minimization of waste.

As the world's largest exporter and second largest importer, China is at the core of global value chains. Having benefited from the historical economic growth of global value chains, China may now use its influence to contribute to the greening of global value chains. To this end, in 2020, CCICED commissioned a Special Policy Study on the Greening of the Global Soft Commodity Value Chain (CCICED, 2020), which analyzed the significance and action strategies of China in greening global soft commodity value chains. This 2021 study builds on that work.

China is entering a new era of development, in which it expects to progress from a well-off society to a “beautiful” and “great modern socialist country” by 2050. The 14th “Five-Year Plan” envisions a new development path that emphasizes the quality, safety and sustainability of development over the quantity of growth. In the wake of disruption to the global economy due to the COVID-19 pandemic, China is pursuing a “dual circulation” economic framework in which domestic and international value chains are mutually reinforcing with the domestic market as the mainstay. China has also pledged to strive for the peak of CO₂ emissions by 2030 and carbon neutrality by 2060. These strategic goals elevate the need for stability and green development in value chains. Greening value chains also aligns closely with China’s “Six Stabilities and Six Securities” policy, which lists supply chain security as one of the “six guarantees” of stability. Building a green value chain will provide solutions and realistic paths to achieve the above goals.

Box 1. Definition of Key Terms

Soft commodities: Raw materials and their derivatives that are grown or produced by the agriculture (crops, livestock), seafood (aquaculture and fisheries) and forestry industries, though this study is focused more on the “big four” forest risk soft commodities – beef, palm oil, soy and timber.

Global value chains: Processes by which value is added across different stages from production to consumption and carried out by actors located in different parts of the world (CCICED, 2016).

Green value chains: A shorthand term for value chains with reduced environmental and social impacts due to responsible production and sourcing of commodities and circular economy measures.

Supply chains: A component of value chains that are principally the logistical linkages at a firm level (CCICED, 2016).

Producer countries: Countries that produce a large quantity of relevant commodities and often export those commodities.

Consumer countries: Countries that consume a significant amount of commodities and often import those commodities.

Due diligence: A risk management process implemented by a company to identify, prevent, mitigate, and account for how it addresses environmental and social risks and impacts in its operations, supply chains, and investments.

Traceability: The ability to follow a product or its components through stages of the supply chain (e.g., production, processing, manufacturing, and distribution).

Greening: A shorthand term for policies and practices that reduce the negative environmental and social impacts of economic investments, activities, and production processes.

Circular economy: A new way to design, make, and use things within planetary boundaries. It involves a holistic approach to value chains that focuses on designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.

Eco-design: A principle of minimizing a product’s negative environmental impacts throughout its lifecycle in the design stage. These may include designing products for repairability, recyclability, flexibility, reuse, disassembly, energy efficiency, packaging reduction, material and chemical safety and life cycle consideration.

Reuse: Raw materials and products are reused for as long as possible.

Just transition: A concept of ensuring social inclusion, decent work for all and poverty eradication in the process of transitioning to a more sustainable economy.

Green finance: Financial instruments used to ensure environmental benefits are considered in any investment activities.

Green Procurement: Governments, businesses, citizens and non-profits use their purchasing power to incentivize environmentally friendly products and services that contributes to sustainable production and consumption.

1.2. Review of Outcomes of the Phase 1 Special Policy Study

The CCICED 2020 Special Policy Study on Global Green Value Chains- Greening China’s “Soft Commodity” Value Chains provided a convincing rationale and concrete policy options (Box 2) for Chinese leadership to green its global value chains for soft commodities— particularly those linked to tropical deforestation, such as soybeans, beef and palm oil. The recommendations in the study were favorably received both within China and by international experts and stakeholders.

Box 2. Key Recommendations of the 2020 CCICED SPS on Global Green Value Chains

1. Establish a national green value chain strategy and provide policy and institutional support

- A. Announce a new Chinese policy initiative on greening soft commodity value chains.
- B. Establish an Inter-Ministerial National Committee on Value Chain Security and Sustainability.
- C. Establish a Global Green Value Chain Institute.

2. Adopt mandatory and voluntary measures to green soft commodity value chains

- A. Strengthen measures to reduce the import of soft commodities from illegal sources.
- B. Strengthen due diligence and traceability systems.
- C. Invest in domestic capacity to rationalize food value chains and improve sustainable diets.

3. Build on existing Chinese policy levers and initiatives

- A. Incorporating green value chain measures into trade agreements.
- B. Increasing Chinese South–South development assistance to support green soft commodity value chains.
- C. Integrating finance for green soft commodity value chains with green finance and the work of the BRI International Green Development Coalition.

Stakeholders in China are increasingly recognizing the importance of greening value chains. The Foreign Environmental Cooperation Center in the Ministry of Ecology and Environment (MEE) established a green value chain institute in 2020. The Ministry of Commerce (MOFCOM) is currently developing a supply chain security index that is likely to include criteria on the sustainability of soft commodity production. The Belt and Road Initiative International Green Development Coalition commissioned a policy study in 2020 on Green Supply Chains, which proposed a [“Green Commodity Supply Chain Index”](#) for Chinese governments, companies, and financial institutions to assess the relative environmental and social risks to the long-term security and stability of commodity supply chains. The Index proposed five indicators including forest loss, water stress, yield growth, risk of illegality, and human development at the jurisdictional level to measure risk to supply chain security and stability. Internationally, China recently engaged in the Forest, Agriculture and Commodity Trade (FACT) Dialogue, which aims to foster collaboration between producer and consumer countries on sustainable soft commodity supply chains as part of the COP26 climate summit.

1.3. Opportunities related to Green Value Chains in China in the Current Economic Context

The COVID-19 pandemic and international trade frictions have had huge impacts on the global economy and keep bringing uncertainties for the future. To achieve economic recovery as soon as possible, countries around the world are introducing stimulus measures to boost their economies. As the second largest economy in the world, China has made ensuring the security and stability of its supply chain one of the priorities of its economic policy. The "Six Stability and Six Guarantees" policy issued by China in 2020 lists the security of the supply chain as one of the "six guarantees" to ensure the stability of employment, financial markets, trade, domestic and foreign investment, and market expectations. Soft commodities represented by corn, soybeans, beef, coffee, wood, etc. are used as basic industrial raw materials, and their supply directly affects the safety of the industrial chain and supply chain. For soft commodities, the green value chain can help reduce environmental risks in their supply chain, ensure long-term stability of supply, and stabilize supply prices. As an example of risk associated with failure to green value chains, a recent study estimated that rising extreme heat from lost forest and savanna vegetation in the Brazilian Amazon and Cerrado regions (between 1985 and 2012) caused soy revenue losses of over USD 2000 per hectare in the 2012-13 growing season (Flach et al, 2021). In addition, tropical forest loss can reduce rainfed agriculture revenues by delaying and shortening the rainy season (Leite-Filho et al. 2021).

China has proposed a new “dual circulation” economic framework, in which the domestic circulation is the center of focus, with the cycles of domestic and international value chains working complementarily to reinforce each other (Xinhua, 2021b). The green value chain can help the "dual circulation" strategy by supporting value chain participants (farmers, manufacturers, suppliers, consumers, etc.) to focus on domestic business. Circular transformation will help promote eco-design, reuse models, and globalization of trade standards, while minimizing excessive reliance on imports of certain commodities. As China takes more proactive domestic measures to combat climate change and achieve the ecological civilization vision, greening value chains provides an opportunity to reduce the international environmental footprint of China’s commodity value chains to complement its efforts domestically. In addition, China can also promote a circular economy through natural resource management, waste reduction, and promotion of a low carbon footprint in the value chain.

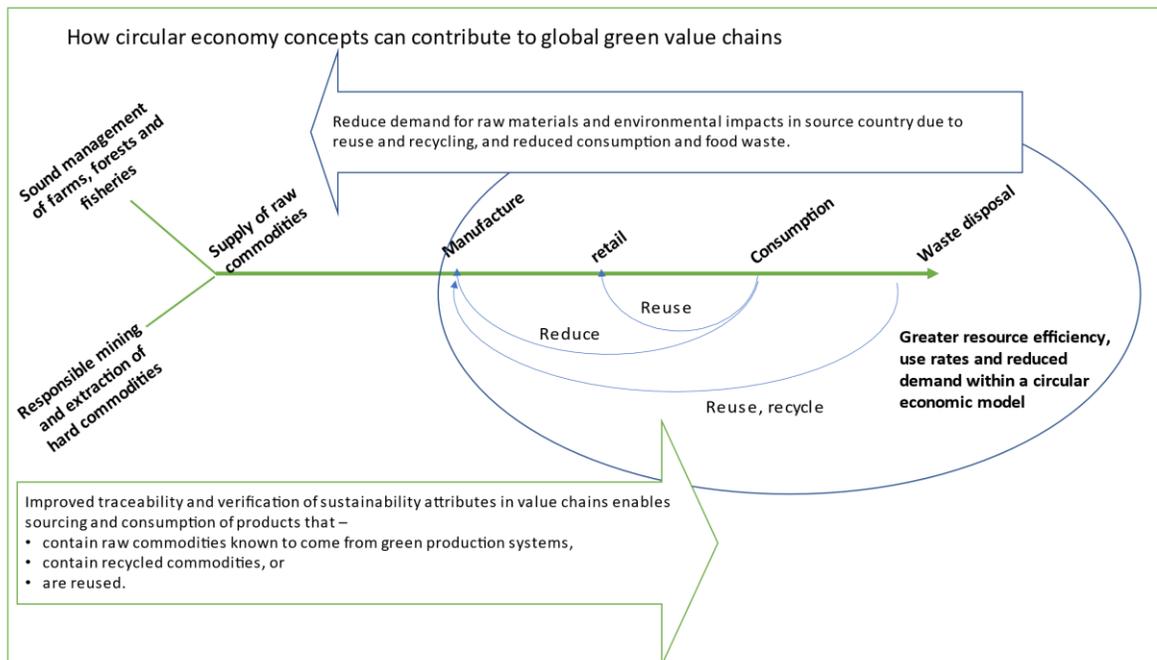
The green value chain is in line with the latest policy priorities and new development models of the "14th Five-Year Plan" (2021-2025). For the first time in history, the Five-Year Plan does not set a specific GDP growth target, but emphasizes the quality, safety and sustainability of development. The Plan proposes to establish a global supply chain early warning system for key resources and commodities, strengthen international cooperation in trade and supply chains, and innovate supply chain financing models. As an innovative management tool, green value chain management can become an important starting point for building a modern environmental management system and winning the battle against pollution. It meets the inherent needs of high-quality development and promotes the resilience and sustainable development of global value chains.

Green value chains are critical for China to achieve its carbon neutral commitment and ecological civilization, and actively contribute to the global agendas on climate change, biodiversity, and sustainable development. The country is stepping up efforts on climate change with President Xi Jinping’s announcement that China will aim to hit peak emissions before 2030 and reach carbon neutrality by 2060. In February 2021, the State Council issued the “Guideline on Accelerating the Establishment and Improvement of a Green, Low-Carbon and Circular Economic System for Development”. This policy signal calls for development with a whole of life-cycle concept, taking in raw material production, processing, manufacturing, product use and end-of-life. Green value chain management coupled with this whole of life concept, can help to achieve energy savings and emissions reductions in a systematic way along the entire value chain. In July 2021, the Ministry of Commerce and the Ministry of Ecology and Environment issued the “Green Development Guidelines for Overseas investment and Cooperation”, which set out major areas of work for government agencies and companies “towards green transition” and “laying the groundwork for a new development paradigm” (MOFCOM and MEE, 2021). These areas of work include: adhering to the concept of green development; promoting green production and operations (including due diligence to identify potential environmental risks, building green supply chains, adopting green procurement and greening the entire product life-cycle); promoting green technology innovation (including strengthening green compliance systems and “setting a standard for business practices overseas to fill in the regulatory gaps”); preventing environmental risks (including encouraging “companies to adopt international or Chinese standards in investing activities where local laws and regulations are non-existent or too lenient”).

China is also implementing circular economy policies to increase longevity of products, re-use of materials and minimization of waste. Today, China has established a legal system to regulate circular economic activities while setting circular economy concept - “reduce, recycle and reuse of resources” a priority for strategic economic growth in the country (Zhao, 2015). Such policies contribute to the greening of value chains by reducing the total volume of raw materials that go into value chains and the volume of industrial

waste coming out of them. Examples of China’s circular economy policies include the memorandum of understanding it signed in 2018 with the EU to exchange knowledge and develop a policy framework to accelerate the adoption of a strong circular economy across the two economies. In 2019, Shanghai introduced a mandatory waste sorting regulation to promote green development and circular economy practices. And just this year, the State Council emphasized the need for low-carbon, circular and cleaner manufacturing systems in industries such as textiles. The State Council is also calling for Chinese citizens to pursue a low-carbon lifestyle, for instance, through minimizing food waste.

Figure 1. How circular economy contributes to green value chains



Source: WRI authors

1.4. Challenges to achieving Green Value Chains in China

While the current economic context offers new opportunities for greening value chains in China, some major challenges need to be addressed to realize those opportunities. First, China lacks a clear and cohesive strategy on green value chains that links to the vision of ecological civilization, its carbon neutrality commitment and other recent policy priorities. The enablers of green value chains cut across the jurisdictional and expertise boundaries of government agencies and sectors. Trade, finance, environment, agriculture, forestry, and customs are all involved in the management of value chains (CCICED, 2020). While each soft commodities or circular economy practice, has a unique context, and therefore demands a tailored policy response, a cross-sectoral approach is also critical for creating an economy-wide policy framework for greening value chains that is consistent, efficient and coherent. The recommendations proposed in Section 4.2 of this study on developing a green value chain coordination and support system in China are a direct response to this challenge. Additionally, China could make a high-level policy commitment to green value chains to provide the impetus for government agencies, companies, financial institutions, and civil society organizations to work together to create and implement a robust green value

chain strategy. As the host of CBD COP 15, China has an opportunity to announce an ambitious commitment to the greening of global value chains, while encouraging other countries to contribute.

A second major challenge is that many Chinese companies (and their suppliers) simply do not yet have the due diligence and traceability systems needed to deliver green products. Without these systems consumers cannot easily make green choices in their day to day purchasing, and companies (and the institutions providing finance to them) remain exposed to the risks associated with unsustainable practices or illegal activity in value chains. Many of the recommendations in section 4.1 of this study address this challenge, including the proposal to introduce regulations related to due diligence, adoption of new technologies to support traceability, creation of new financial instruments, and the inclusion of green value chain measures in trade agreements.

A third challenge is the lack of a holistic, systemic approach to upscaling circular economy concepts and standards as drivers of green value chains. Despite the tremendous progress towards circular economy in China, many challenges remain. For instance, scaling of circular economy in the mainstream economy is impeded by a tolerance for low output efficiency of resources used in key industries, the lack of standard systems for recycling and reuse, high production intensity and low-rate usage of recycled products as raw material, fragmented approaches to standards and certification for recycled products, lack of sufficient financial incentives and business models predicated on unchecked consumption (14th "Five-Year Plan").

1.5. Main Research Topics

Building on the study in 2020, this 2021 study goes deeper into the challenges and opportunities related to greening global value chains in China. This second study –

- provides more detailed analysis of regulations and technologies to encourage due diligence and traceability in soft commodity value chains, and related trade and finance measures.
- explores how circular economy solutions can help make value chains greener.
- makes high-level framework and policy recommendations on mechanisms to coordinate and provide technical support to the development and implementation green value chain strategies in China.

With respect to soft commodity value chains, this study builds on the recommendations from the 2020 SPS (see Box 2 above). It explores emerging norms for legality and sustainability of soft commodity value chains (Section 2.1) and international and Chinese experience on due diligence and traceability measures for selected soft commodities including the role of technologies in greening soft commodity value chains (Section 2.2).

This study also explores how circular economy concepts can contribute to greener value chains in China. It begins with a discussion of the role and potential of circular economy in greening value chains and ties circular economy to the strategic plans and policies set forth by the Chinese government (Section 3.1). The study then explores five cross-cutting enablers of circular economy policies and practices (Section 3.2). We focus on apparel, food, timber and plastics because of their large climate impacts and the immense volumes of waste and pollution associated with these sectors. Additionally, apparel, food and timber have direct links to soft commodity value chains.

2. Greening the Production and Sourcing of Soft Commodities in Value Chains

2.1. Emerging Norms for Legality, Sustainability and Traceability in Soft Commodity Value Chains

Box 3. Key takeaways – Emerging Norms for Soft Commodity Legality, Sustainability and Traceability

- Major markets are developing legislation to require due diligence for legality/sustainability in soft commodity sourcing.
- Many countries that supply soft commodities have laws restricting forest conversion and degradation and tracking systems to verify commodities are produced in compliance with such laws. For commodities produced in countries with strong laws but weak governance, China can manage risks of sourcing from illegal or unsustainable sources by requiring or encouraging Chinese companies to develop and apply their own due diligence and traceability systems. In doing so, China can draw on experience gained in the timber sector through the Chinese Timber Legality Verification Scheme.
- WTO rules allow China to include measures in bilateral and multilateral trade agreements to make soft commodity value chains. China can work with soft commodity producer countries entering such agreements to co-design related green standards and implementation mechanisms.

2.1.1 Regulations and public policy

Many countries that produce or consume forest-risk commodities have or are developing regulatory measures and policies that support the greening of soft commodity production within value chains. The paragraphs below provide an overview of these measures and policies and Table 1 lists specific country examples.

Consuming country due diligence laws - Such laws require companies to conduct due diligence to ensure the commodities they source are produced legally, and/or in compliance with critical social and environmental safeguards, in their country of origin. Greatest progress has been made in the timber sector, with the European Union, United States, Australia, Japan, and South Korea all requiring some form of due diligence to ensure wood products are not made from illegally harvested timber. These countries account for 52% of the world’s forest product imports (FAO, 2020). In addition, in recent years, the UN Convention on International Trade in Endangered Species (CITES) has listed hundreds of timber species, many of which feed the Chinese furniture industry, for protection from illegal trade. Momentum is building within China, and internationally, for a similar approach to deforestation-risk agricultural commodities, with legislation under development in European Union, the UK and USA that would require companies to do due diligence on specific agricultural commodities to ensure they are not associated with illegal deforestation.

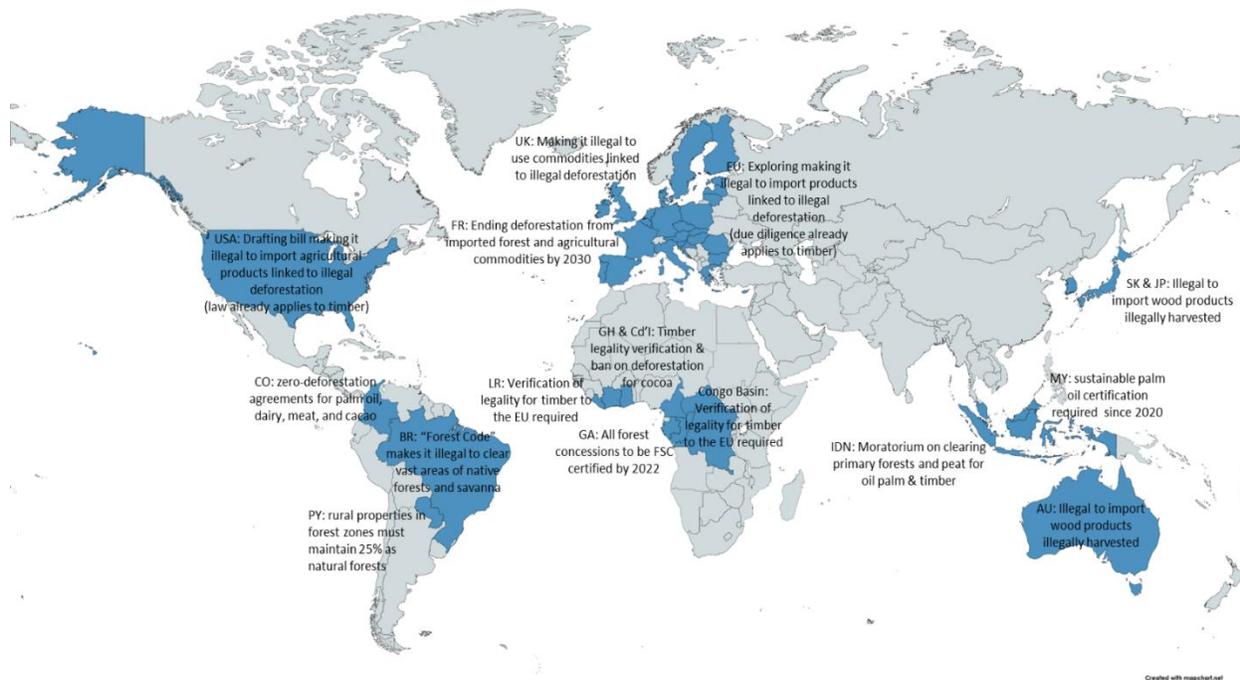
Producer country prohibitions on conversion of forests and other natural ecosystems - Most countries have laws restricting conversion of forests and other natural ecosystems to pasture, croplands or plantations. These include land-use planning processes that define “no-go” zones for agricultural development, regulations under which permits are required for land clearing or logging, and prohibitions on conversion of specified ecosystems to other land-uses. Indonesia, for example, has a permanent moratorium on new forest clearing for plantations, or the issue of new logging permits, in primary forest or peatland. Brazil’s Forest Code stipulates the maximum land area per farm that can be cleared for agriculture in each biome, e.g., 20% in the Amazon, 65-80% in the Cerrado (Soares-Filho et al., 2014).

Producer country systems to verify legality - Producer countries are increasingly setting up government-administered or independent tracking systems and procedures to verify that commodities destined for export or domestic consumption are produced legally and/or sustainably. For example, 15 tropical countries have entered into Voluntary Partnership Agreements with the European Union to ensure that timber exported to the EU comes from legal sources. Typically, these agreements require the producer countries to set up mandatory public timber traceability systems and reporting platforms. The EU has recognized Indonesia's progress in establishing such systems by granting Indonesia a license that effectively exempts Indonesia's timber from requirements related to verifying legality under the EU Timber Regulation. Gabon has gone a step further by making it mandatory for forestry concession holders to achieve Forest Stewardship Council certification by 2022. Producer countries are beginning to apply similar approaches to deforestation risk agricultural commodities. For example, the world's two biggest palm oil producers, Indonesia and Malaysia, both require producers to secure certification under national palm oil sustainability standards.

Producer country jurisdictional approaches - In many producer countries, sub-national jurisdictions (provinces, states, districts and municipalities) are setting and enforcing no-go zones for commodity production, so they can present as "green" jurisdictions that gain preferential access to markets. A Tropical Forest Alliance (TFA) report published in 2017 documented 34 jurisdictional programs in tropical forest regions that are supporting sustainable sourcing and production strategies within value chains for palm oil, soy, coffee, cocoa, pulp, and beef. (TFA, 2017). These programs typically combine public land-use planning and governance reforms with corporate activities to promote sustainable commodity production. The combination of public and private interventions means these programs are well-placed to enhance sharing of data and best practices, aggregate and provide incentives to smallholders, and have an impact at scales beyond the landholdings of individual producers (Taylor and Streck, 2018). These approaches can also be implemented at national level. For example, the governments of Côte d'Ivoire and Ghana are participants in the Cocoa and Forests Initiative along with leading cocoa and chocolate companies, as a joint effort to promote sustainable smallholder cocoa production, social inclusion, and forest protection (Kroeger et al., 2017).

Public procurement policies that give preference to green commodities - Through green public procurement, public authorities can set preferences or offer incentives for the procurement of green soft commodities. Globally, green procurement is more advanced in sectors such as construction (including wood), office supplies (including paper) and energy (including bioenergy). However, some authorities have made commitments to require deforestation-free procurement for food and catering.

Figure 2. A growing number of countries have policies in place to support green soft commodity value chains



Source: information compiled by WRI

Table 1. Country examples of regulatory measures and policies that support the greening of soft commodity value chains

Developing Countries	
Indonesia	<ul style="list-style-type: none"> • The <i>Timber Legality Assurance System</i> (locally known as SVLK) verifies the legal supply of timber for export of domestic consumption. Indonesia also has a log export ban. • Under the Indonesia Sustainable Palm Oil (ISPO) regulations, palm oil plantations must secure certification that they are operating legally. • In 2019, the Indonesian president announced a permanent moratorium on conversion of primary forests and peat lands. • Indonesia has a <i>Voluntary Partnership Agreement</i> (VPA) with the EU and is currently the only country that can issue FLEGT licenses to ensure that timber exported to the EU is from legal sources. • 10 provinces and 36 districts have jurisdictional initiatives to reduce deforestation.
Malaysia	<ul style="list-style-type: none"> • Since 2020, palm oil producers must obtain certification under the Malaysian Sustainable Palm Oil standard to comply with MPOB (Licensing) 2005 Regulation No. 15, or face penalties and risk having their licenses suspended or revoked. • Sabah State has a jurisdictional initiative to reduce deforestation
Brazil	<ul style="list-style-type: none"> • The <i>Forest Code</i> stipulates the maximum land area per farm that can be cleared for agriculture per biome (e.g., 20% in the Amazon, 65-80% in the Cerrado). • Mato Grosso state has a “<i>Produce, Conserve and Include</i>” strategy to advances a sustainable rural development agenda through implementation of the intensification of commodity production within existing degraded lands, restoration of other degraded lands to forest, and provision of improved extension services and rural credit to producers. • The <i>Brazilian Central Bank</i> has specific regulations on sustainability due diligence for the financial sector, including requirements that prohibits/prevents loaning to illegally deforested

	<p>areas, and banks can be fined if they do not comply. A public consultation is currently ongoing to impose new sustainability rules on the rural credit.</p>
Colombia	<ul style="list-style-type: none"> Colombia has signed the Cocoa, Forest & Peace Initiative, which seeks to eliminate cocoa-related deforestation Colombia has zero-deforestation agreements with the palm oil, dairy, meat and cacao industries
Paraguay	<ul style="list-style-type: none"> The <i>Forestry Law</i> requires that rural properties over 20 ha in forest zones must maintain 25% as natural forest in addition to riparian forests
Liberia	<ul style="list-style-type: none"> Liberia has a VPA with the EU to ensure that timber exported to the EU come from legal sources.
Côte d'Ivoire	<ul style="list-style-type: none"> Côte d'Ivoire has a VPA with the EU to ensure that timber exported to the EU come from legal sources. Côte d'Ivoire is part of the Cocoa & Forests Initiative, which seeks to end deforestation and restore forest areas in cocoa producing areas
Ghana	<ul style="list-style-type: none"> Ghana has a VPA with the EU to ensure that timber exported to the EU come from legal sources. Ghana is part of the Cocoa & Forests Initiative, which seeks to end deforestation and restore forest areas in cocoa producing areas
Cameroun	<ul style="list-style-type: none"> Cameroun has a VPA with the EU to ensure that timber exported to the EU come from legal sources.
Gabon	<ul style="list-style-type: none"> Gabon has made it mandatory for forestry concession holders to achieve FSC certification by 2022 Gabon has a VPA with the EU to ensure that timber exported to the EU come from legal sources.
CAR	<ul style="list-style-type: none"> The Central African Republic has a VPA with the EU to ensure that timber exported to the EU come from legal sources.
DRC	<ul style="list-style-type: none"> The Democratic Republic of Congo has a VPA with the EU to ensure that timber exported to the EU come from legal sources.
ROC	<ul style="list-style-type: none"> The Republic of Congo has a VPA with the EU to ensure that timber exported to the EU come from legal sources.
Developed Countries	
EU	<ul style="list-style-type: none"> The EU Timber Regulation (2010) prohibits the placing of illegally sourced wood products on the European market and requires operators and traders to exercise due diligence to minimize the risk of importing illegally harvested timber. The EU Communication on Stepping up EU Action to Protect and Restore the World's Forests (2019) highlights 5 priorities including one on reducing the footprint of EU consumption on land and encouraging the consumption of products from deforestation-free supply chains in the EU. The EU LULUCF Regulation (2018) requires EU countries to ensure that greenhouse gas emissions from land use, land use change or forestry are balanced by at least an equivalent removal of CO2 from the atmosphere in the period 2021 to 2030.
France	<ul style="list-style-type: none"> France's Corporate Duty of Vigilance Law (2017) requires large French companies to assess and address the adverse impacts of their activities on people and the planet, by having them publish annual, public vigilance plans. In 2017, France adopted its National Strategy against Imported Deforestation which aims, by 2030, to put an end to deforestation caused by importing unsustainable forest and agricultural products.
UK	<ul style="list-style-type: none"> The UK adopted an Environment Bill in November 2020 to require due diligence from businesses to ensure deforestation-risk commodities have been produced in line with local laws protecting forests and other natural ecosystems.
USA	<ul style="list-style-type: none"> The US Lacey Act Amendment (2008) prohibits trade in illegally sourced wood products. A draft bill on illegal deforestation authored by Senator Brian Schatz is under discussion in

	the US congress. It would prohibit the import the products linked to illegal deforestation.
Japan	<ul style="list-style-type: none"> Japan’s Clean Wood Act (2016) requires companies to ensure that domestic or imported timber is harvested legally.
Republic of Korea	<ul style="list-style-type: none"> The Republic of Korea’s Act on the Sustainable Use of Timbers (2017) requires companies to ensure that domestic or imported timber is harvested legally.
Australia	<ul style="list-style-type: none"> Australia’s Illegal Logging Prohibition Act (2012) prohibits the import of wood, pulp and paper products made from timber that is logged illegally, or the processing of raw logs of such timber.

2.1.2 Voluntary private sector norms and best practice

In addition to government measures supporting green value chains, the portion of private sector actors with commitments to Green Value Chains is growing, and new best practice norms are emerging. The Global Canopy Forest 500 Project assesses 350 companies, and 150 financial institutions, with high influence on forest-risk supply chains. In 2021, the percentage of those companies with commitments to halt deforestation associated with soft commodities were: 71% for palm oil; 66% for timber; 48% for paper; 31% for soy; 28% for cattle; and 25% for leather. The percentage of those financial institutions with deforestation policies covering their investments in activities linked to soft commodities were: 32% for palm oil; 32% for timber; 24% for soy; and 20% for cattle (Global Canopy, 2021).

The business reasons for companies to pursue green value chains are many, including: securing the long-term stability of supply (and therefore price) of commodities; mitigating legal and reputational risks; anticipating future markets in which consumers are more concerned with the impacts of what they buy; meeting the sustainability standards of multinational retailers and manufacturers who they supply; better management of logistics and financial discipline in the value chain; and new technologies are making traceability easier and more affordable (CCICED, 2020).

At the forefront of private sector action to green soft-commodity value chains, the [Forest Positive Coalition](#) of companies is seeking to “drive collective, transformative change in order to remove deforestation, forest conversion and degradation from key commodity supply chains and support forest positive businesses” (Forest Positive Coalition, 2021). The coalition has two core strategies –

- transitioning from deforestation- and conversion-free supply chains to deforestation- and conversion-free businesses (i.e., they want the whole of their suppliers’ operations to be green, rather than just the specific commodities they buy) and
- taking a more integrated land use approach to encourage more transformational change in key production landscapes through stakeholder collaboration (this links strongly to jurisdictional approaches described above).

The [Accountability Framework Initiative](#) provides a consensus-based set of norms, definitions, and guidance on how to achieve green soft commodity value chains. It provides guidance on how companies can set commitments, take action, and monitor progress toward achieving value chains that are free from deforestation, conversion, and human rights violations (Accountability Framework Initiative, 2021a).

Growing interest in how companies account for greenhouse gas emissions in the their land-based operations and soft commodity value chains has motivated the [Greenhouse Gas Protocol](#), a multi-stakeholder global coalition that sets rules and standards on how to measure and manage greenhouse gas emissions, to develop new guidance on how companies and organizations should account for **greenhouse gas** emissions and carbon removals from **land use, land use** change, bioenergy, and related topics in their **greenhouse gas** inventories (Greenhouse Gas Protocol, 2021).

Increasingly, leading companies are calling for mandatory due diligence laws to level the playing field (see Box 4).

Box 4. Leading companies call for mandatory due diligence laws

In October 2020, a group of companies sent a letter to the UK government, encouraging the introduction of mandatory due diligence requirements to address global deforestation (Aldi Stores GB et al., 2020). The companies expressed support for the UK government’s intention to “set a level playing field where sustainable commodities are the norm”. They asked the government to consider the following:

1. Align the definition of deforestation-free with what is necessary to achieve Net Zero, citing the Accountability Framework Initiative and Global Resources Initiative as sources of definitions that include all forms of deforestation and land conversion (Accountability Framework Initiative, 2021a; Global Resources Initiative, 2020).
2. Adopt thresholds that reflect the scale influence of the company.
3. Facilitate an enabling environment for our companies to act.
4. Implement sector-specific requirements. Commodities should have different and pragmatic pathways in place that recognize the differences in their production and supply chain contexts.
5. Protect the vulnerable, recognizing that smallholders are often the most marginalized part of the supply chain.
6. Incentivize good behavior not only avoidance of problem areas.
7. Allow for restoration and remediation.
8. Continue to consult and collaborate with the private sector.

2.1.3 Finance sector norms and best practice

A study in 2017 by the G20 Green Finance Group concluded that environmental risk analysis by financial decision-makers can result in improved credit and investment policies; reduced portfolio and firm-level risk; product innovation; reallocation of capital and enhanced stakeholder engagement. However, barriers to wider adoption of environmental risk analysis practices can include: a lack of clear and consistent policy signals; limited methodologies and relevant data; capacity limitations within financial institutions; time horizons; terms of investment; and performance incentives. The study also found that the lack of, and difficult access to, relevant use of publicly available environmental data limits the ability of financial firms and other to analyze and manage environmental risk exposures. It also hinders the reallocation of resources to financing green investment opportunities (G20 Green Finance Study Group, 2017).

In China, the State Council approved “Guidelines for Establishing the Green Financial System” in 2016, to incentivize and promote green loans, green bonds, green funds, green insurance, and mandatory environmental information disclosures, and other forms of green finance. (The People’s Bank of China et al., 2016).

As part of this growing attention to green finance many banks are developing new products and services that could support actions by clients to green their value chains. For example, banks are offering sustainability-linked loans where terms are linked to non-financial key performance indicators related to the sustainability of the borrower’s value chain. Recognition of deforestation-driven climate risks is also growing along with calls for greater disclosure of such risks. Some examples are given below.

In 2019, Marfrig, a Brazilian beef producer, issued a “sustainable transition bond” the proceeds of which would be used to ensure the cattle it purchased did not come from deforested areas, protected areas or areas that violate indigenous land rights. In 2021, Impact fund *&Green* made a \$30 million, 10-year ‘sustainability-linked loan’ to Marfrig to expand the reach of its cattle tracking and deforestation monitoring system to indirect suppliers. Potential interest rate reductions are linked to Marfrig’s ability to reach traceability on its indirect suppliers more quickly than the target dates set out in the loan agreement.

Emerging financial mechanisms such as credit lines for low-carbon agriculture, and low-cost crop finance, could help make deforestation and conversion free farming more competitive with the alternative of clearing native vegetation to create new farming land. In cases where farmers already own land with native vegetation, farmer compensation programs could be deployed to create incentives for farmers to retain native vegetation on their land (The Nature Conservancy, 2019).

In 2019, COFCO International secured a sustainability-linked loan of US \$2.1 billion from a consortium of 20 banks, including Chinese banks, with interest savings based on its performance against environmental, social, and governance targets, including the sustainable sourcing of soy in Brazil (Wragg, 2019).

In issuing its communication on *Stepping up EU Action to Protect and Restore the World's Forests* in 2019, the European Commission signaled interest in measures to improve company reporting on activities linked to deforestation and forest degradation. The Taskforce on Nature-related Financial Disclosures has begun developing a framework for nature-related reporting, which it hopes to test and refine ahead of launch and dissemination in 2023. The idea is that standardized reporting on nature-related risks will improve transparency and accountability linked to deforestation and motivate financial institutions to deliver on zero deforestation commitments.

CDP runs a global environmental disclosure system on which over 9,600 companies have reported on climate change, water security and forests. Investors use this data to inform decision making, engage with companies, reduce risks and identify opportunities. In 2020, 687 companies reported on the steps they are taking to eliminate deforestation from their operations and supply chains (CDP, 2021)

In 2019, 230 institutional investors representing \$16.2 trillion in assets under management called on companies to take urgent action following the devastating forest fires in the Amazon (Ceres, 2019). In 2020, [Ceres](#) published *The Investor Guide to Deforestation and Climate Change*, which provides a framework to help investors understand and engage on deforestation-driven climate risks across their portfolios and proposes concrete steps investors can take to address deforestation risk (Ceres, 2020).

2.1.4 Trade norms

Multilateral and bilateral trade agreements can be enablers of both the upstream and downstream of green value chains, provided they comply with World Trade Organization (WTO) rules. WTO rules not only play an important role in multilateral trade discussion but also lay the foundation for bilateral free trade agreements (Erixon and Lamprecht, 2020).

Countries are increasingly using trade measures to achieve environmental objectives. In 2019, the WTO recorded 672 environmental notifications by member countries (WTO, 2021b). Around one sixth of WTO members have notified trade measures that include environmental components, and 51% of such measures notified in 2018 came from developing and least developed countries (WTO, 2020a). Most environmental-oriented trade measures do not raise any disagreement in the WTO. Only 10 disputes

involving environmental measures have been decided at the WTO and in all cases the validity of environmental objectives was never questioned (WTO, 2020a).

WTO members can adopt trade-related measures for environmental, health, and conservation policy goals if such measures comply with the General Agreement on Tariffs and Trade (GATT) rules or fall under the exceptions to these rules (WTO, 2021a). The GATT rules require that environmental measures not violate basic trade rules such as the non-discrimination obligation (see Box 4) and the prohibition on quantitative restrictions; however, there are exceptions for WTO members to achieve legitimate policy objectives. Related to measures on sustainability and environment, the GATT Article XX on General Exceptions allows WTO members to adopt policy measures that are inconsistent with GATT disciplines, but necessary to protect human, animal or plant life or health, or relating to the conservation of exhaustible natural resources (see Box 5). WTO members' autonomy to determine their own environmental objectives has been reaffirmed by several cases (WTO, 2021a).

Box 5. WTO's principle of non-discriminations and GATT exceptions

Under WTO, the principle of [non-discrimination](#) stipulates that a member shall not discriminate:

- between “like” products from different trading partners (giving them equally “most favored-nation” or MFN status, [GATT Article I](#)); and
- between its own and like foreign products (giving them “national treatment”, [GATT Article III](#)).

GATT Article XX on General Exceptions lays out a number of specific instances in which WTO members may be exempted from GATT rules. The two exceptions related to sustainability and environment are described in paragraphs (b) and (g) of Article XX.

- (b) necessary to protect human, animal or plant life or health; ...
- (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption. ...”

Source: WTO, 2021b

Trade measures focused on preventing the degradation, fragmentation, or conversion of natural forests and other natural ecosystems, would align with the exceptions in the GATT Article XX regarding the protection of plant life and conservation of exhaustible natural resources. Thus, measures related to greening soft commodity value chain measures are allowable provided they are designed with strong scientific support and avoid arbitrary or unjustifiable discrimination (Erixon and Lamprecht, 2020 & WTO, 2020a).

Countries have multiple options to design measures that support and implement green soft commodity value chains in trade agreements (see Box 6). For example, the EU has signed Voluntary Partnership Agreements (VPAs) with seven timber-producing countries to ensure that timber and timber products exported to the EU come from legal sources (EFI, 2020). The VPAs are legally binding trade agreements that include measures for timber-producing countries to control, verify, and license legal timber and for the EU to only accept licensed imports from producing countries. The United States-Peru Trade Promotion Act (PTPA) is a general free trade agreement but includes a legally binding Forest Governance Annex that sets out specific policy and institutional mechanisms to reduce the risk of illegally harvested timber from Peru entering the United States (CCICED, 2020).

Box 6. Types of environmental provisions in trade agreements

General environmental provisions:

- A reference in Preamble
- General and specific exceptions based on GATT Article XX
- A commitment to uphold environmental law, and not weaken it to attract trade

Substantive environmental provisions:

- Environmental cooperation
- Public participation
- Dispute settlement
- Coverage of specific environmental issues
- Specific provisions on Multilateral Environmental Agreements (MEAs)
- Implementation mechanism
- Associated ex ante impact assessment

Source: OECD, 2014

In addition to official trade agreements, countries could also support plurilateral initiatives that promote greener value chains at regional or international trade dialogues. For example, in 2020, 50 WTO members launched an initiative to organize structured discussions at WTO on trade and environmental sustainability that include information sharing, environmental cooperation, and capacity building. Seven WTO members led by China and Fiji established an open-ended informal dialogue on plastics pollution and environmentally sustainable plastics trade (WTO, 2020b).

2.2. Due Diligence and Traceability Measures for Soft Commodities

Box 7. Key takeaways on Due Diligence and Traceability

- A revolution in monitoring and tracking technologies is making due diligence and traceability more feasible, practical and affordable. That same revolution makes it easier for producers (especially small/medium-size enterprises) to verify their compliance with green criteria.
- By adopting these systems, Chinese companies can be ready to comply with new regulations by countries that import or export commodities.
- China has already issued detailed guidance on the role of governments and companies in establishing traceability systems for certain products. Government bodies and companies can draw on this guidance and experience gained in China in sectors such as meat and vegetables, alcoholic products and drugs and herbal medicines, to strengthen traceability for other soft commodities.

2.2.1 International experience - feasibility, practicality, costs, and strategy for developing enhanced legality due diligence and value chain traceability measures for soft commodities

When used in combination, due diligence and traceability can verify a commodity's origin, the chain of custody, and compliance with legality, sustainability, and/or safety standards. They often make good business sense, enabling companies to better manage logistics and ensure financial discipline throughout the value chain, as well as providing a competitive advantage to companies that can demonstrate they are procuring commodities from known and sustainable sources.

For the purposes of this study, due diligence is a process to assess and reduce the risk that commodity production within a value chain or financial portfolio is linked to illegal or unsustainable practices. It involves gathering relevant information about suppliers and where they produce, harvest or source commodities, along with information about production practices and control measures in those places. The process enables a company to assess risk of non-compliance with regulations or a sustainability standard and take measures to mitigate the risk and verify compliance.

Traceability is the ability to follow a product or its components through the production, processing, manufacturing and distribution stages of the supply chain. Achieving traceability often requires companies to identify the various actors in their supply chain and understand the relationships among them—a process known as supply chain mapping (Accountability Framework Initiative, 2021b). Adequate traceability is an essential component of a green value chain. A diverse array of tools and approaches (e.g., online forest monitoring systems that provide access to satellite and related data to assess locations of ongoing deforestation; voluntary certification systems that offer third-party verification that commodities were produced in compliance with a sustainability standard and that the chain of custody is adequately controlled; supplier warranties and related supplier reporting systems; techno) are available to support due diligence and traceability.

2.2.2 International examples of company due diligence and traceability systems for soft commodities

Large brands and retailers

Walmart has committed to sourcing 20 commodities more sustainably and has diverse practices to achieve this. It requires its suppliers to set targets and report on key sustainability indicators on a centrally managed program called *Project Gigaton* (Walmart Sustainability Hub, 2021). Additionally, it works with its main beef suppliers in the Amazon region to fully trace their direct beef supply and has committed to guarantee 100% of the beef it sources from Brazil, Argentina and Paraguay will be deforestation-free by the end of 2021 (Eastham, 2020). Since 2018, the company has been tracing all its leafy green suppliers using blockchain technology (Corkery and Popper, 2018). Walmart works with over 3,000 suppliers in China on green sourcing. It has also completed a proof-of-concept pilot to trace pork products back to the farm in its Chinese operations using blockchain ([Walmart, 2019](#)).

Mondelez has mapped and published the mill locations of 100% of their direct palm oil suppliers (Mondelēz International, 2021). The company is implanting systems to achieve full traceability of its palm oil to plantation level (i.e. pre-mill traceability) 100% of supply traced to the field by 2021 (Mondelēz International, 2020). It has also mapped over 90 thousand small-holder cocoa farmers in West Africa and constantly monitor this supply for deforestation using satellite-based software (Charles, 2019).

Unilever has also mapped 100% of its suppliers' palm oil mills and publishes the suppliers it has stopped doing business with because of non-compliances with its due diligence requirements (Unilever, 2020b). The company is using satellite data and cellphone tracking to trace the source plantations of its indirect palm oil supply (Unilever, 2020a).

Multinational food companies

Bunge traces 100% of its direct soy purchases to the farm level in the Brazilian regions with higher risk of soy-related deforestation, publishing quarterly traceability reports (Bunge, 2020). It has also launched an unprecedented program to trace 100% of its indirect soy supply to the farm level (Bunge, 2021).

COFCO International also announced recently that it will fully trace its direct soy supply in Brazil by 2023 (COFCO International, 2020).

JBS and **Marfrig**, the first and second biggest animal protein producers in the world, have been tracing 100% of their direct beef supply in the Amazon region for almost a decade. Together they represent more than 50% of all Chinese imports of beef from Brazil (Trase, 2021). Both companies recently committed to new systems to trace 100% of their indirect suppliers to the farm level and to zero deforestation in Brazil (Bloomberg, 2020). Marfrig has raised a blended-finance long-term focused investment to fund these efforts and JBS will use blockchain technology (AndGreen Fund, 2021b; JBS, 2020). Also, these traceability efforts have enabled Marfrig to establish a producer support scheme, called Marfrig Club. Through the scheme, ranchers receive technical assistance and information to support their businesses. JBS has also announced a Together for the Amazon fund, that will fund ranchers in forest regions that meet forest protection requirements.

Local and medium-sized companies

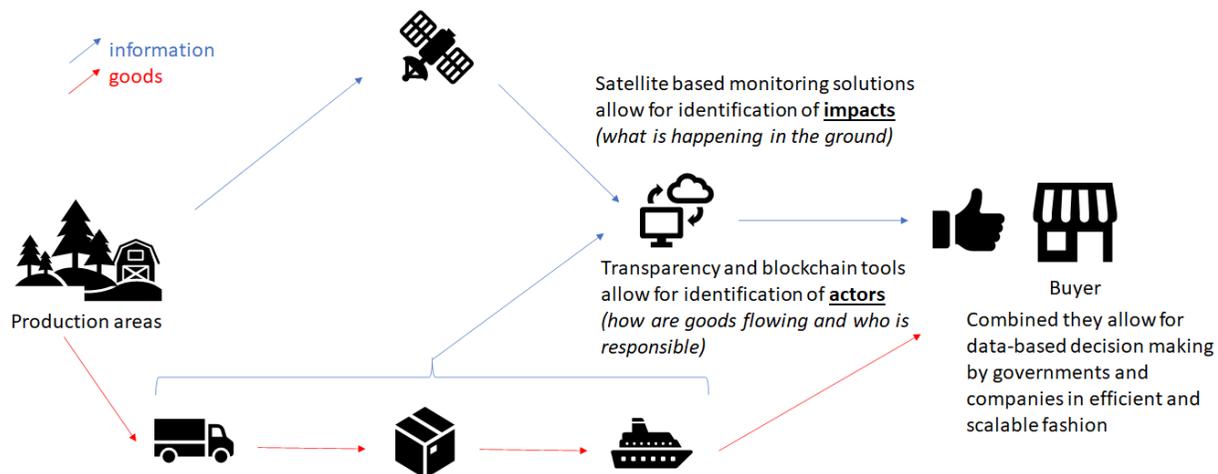
Grupo Exito, a Colombian retailer maps its cattle suppliers using the freely available Global Forest Watch Pro system. The system allows companies of any size to manage their supply chain risk, anywhere, using satellite data. Grupo Exito has mapped more than 37,000ha of farmland in their supply chain and identified that 65% of this land complies with its no-deforestation policy. The company claims to be a leader “in the transformation of the productive livestock industry” in Colombia (Semana, 2020).

Banco Sudameris, a Latin American bank, has relied on commitments to manage the sustainability risk in its investment portfolio, to secure concessional development capital from IDB Invest, the private sector arm of the InterAmerican Development Bank. The bank uses geospatial monitoring systems to conduct due diligence on new investments, and to both verify compliance with its sustainability policies and provide support to its clients, farmers in Latin America. In a reported case, the bank received an alert from *Global Forest Watch* of a fire on a large ranch of a client and informed the client so that the fire could be contained before it destroyed the whole property and the cattle on it (Guthrie, 2018). Through the *Paraguayan Roundtable of Sustainable Finance* significant number of banks in the country now use the Global Forest Watch Pro system to monitor deforestation events or near their client’s properties (Sarsfield, 2019). The same system is used by companies, large and small, in over 30 countries.

DSNG, a medium-sized palm oil producer in Indonesia, has committed to supplying deforestation-free palm oil and is implementing systems to provide full traceability of its suppliers. This activity has enabled the company to secure a US\$30million long-term loan from a blended-finance facility specialized in inclusive agriculture and forest protection. According to a company statement, “the long-term loan facility provides DSN Group the flexibility to diversify its sources of funding amidst a volatile global credit market backdrop impacted by the COVID-19 pandemic” (DSN Group, 2021). According to the investor “8,000 smallholder farmers and 11,000 individuals are expected to benefit from jobs, services and improved incomes as the NDPE [no deforestation, no peat, no exploitation policy] is implemented” (AndGreen Fund, 2021c).

2.2.3 The role of technologies in strengthening due diligence and traceability systems

Figure 3. Technologies enable due diligence and traceability across the value chain.



The complexity of global value chains, and lack of alignment between the policies and traceability systems of different countries, poses many challenges related to the tracking and monitoring of soft commodities, and attributes related to sustainability and legality, through the entire production process. However, new science and technology is generating methods and tools to overcome these challenges. Examples of technologies that can support due diligence and traceability are described below.

Satellite-based remote sensing: Advances in remote sensing and cloud computing have created a wide array of options for large-scale forest and land monitoring. These technologies have enabled better detection of land cover change, more frequently, over larger areas, at less cost. At the same time, geographic positioning systems, allow field staff to record more detailed coordinate points for their observations and upload those data into geographic information systems. This generates richer data and the means to ground-truth and refine automated systems for interpretation, visualization and analysis of satellite data at global, continental or national scales (Taylor et al, 2020). Satellite imagery spatial resolution and availability continue to improve. The European Space Agency provides open 10-meter data from the sentinel radar satellites that can see through cloud cover, smoke, and haze (Reiche et al., 2016). An increasing number of commercial satellite companies (e.g., *Planet, TerraSar*) offer high spatial resolution data (under 3 meters). While mass processing of such high-resolution imagery is often too costly for use in large-scale systematic analyses, the imagery provides a very cost-effective means of validating, calibrating, and verifying large-scale data. For example, it can be used to training algorithms that can make use of lower resolution free imagery for large scale mapping. Additionally, their costs have been significantly dropping year on year. In 2020, a partnership between Planet (an imagery provider) and the Norwegian government made near real time, high-resolution, imagery free and open for all tropical forest areas (O’Shea, 2020).

Online-geospatial intelligence platforms: Drawing from satellite-based remote sensing, online tools now allow for monitoring of impacts of commodity supply chains. For example, the *Global Forest Watch Pro* application combines remote sensing data and cloud computing to help companies assess, monitor and report the risk of deforestation occurring in the farms or supply sheds around the mills, silos, or slaughterhouses from which they source (Amaral and Lloyd, 2019). *Agroideal* is a territorial intelligence system that allows business planning for more sustainable expansion of investments and procurement in key soft commodities in South America. IBAT (Integrated Biodiversity Assessment Tool) provides authoritative geographic explicit information – like maps or reports - about global biodiversity.

Online transparency tools: The *Open Timber Portal* provides information about forest management practices and legal compliance in participating countries and companies. The portal enables geospatial data, timber producer information, legal documents, and observations by third party forest monitors to be consolidated and presented in user-friendly formats. *SPOTT* (Sustainability Policy Transparency Toolkit) tracks transparency of palm oil companies. It scores tropical timber, palm oil and natural rubber companies annually against over 100 sector-specific indicators to benchmark themselves.

GPS tracking systems: These support traceability by tracking the movement of freight and transport fleets on land or sea. Satellites detect signals from transponders mounted on ships or vehicles that identify their location, route, speed and type. This data can be processed in near-real time via cloud computing and applied to improve supply chain logistics (e.g., by enabling the reprogramming of routes to avoid delays or updating customers on expected delivery times) and to track the movement of commodities from place to place.

Blockchain: Block-chain technology to ensure the authenticity of information can be applied to increase traceability and visibility of transactions in a supply chain. Numerous recent scientific publications have explored the potential for blockchain technologies to meet consumers' needs for traceability. For example, IBM offers a traceability service called *IBM Food Trust*, which was used to create the *Beefchain* tool to trace meat origin in the US to track disease outbreaks in livestock. Other examples include projects by Walmart for eggs and Carrefour for poultry. These traceability solutions improve sustainability while also addressing health and safety and resilience in animal protein supply chains (Patelli and Madrioni, 2020). Starbucks is using blockchain to enable consumers to trace coffee purchased in their stores back to a source plantation in northern Kenya. The shipping company, Maersk, created *TradeLens*, a blockchain-based platform that enables everyone in a complex supply chain to track all documents related to the product and participating businesses. The Forest Stewardship Council uses blockchain to avoid fraudulent use of its certification system. The blockchain verifies the traceability of the certified products along the entire value chain, from the sourcing area, to trading partners, and final users (FSC, 2020).

Labeling and data recording technologies in chain of custody systems: These facilitate rapid collection of large amounts of data that can be electronically, time-stamped and cross-checked against records made at other checkpoints to detect and deter tampering (ITTO, 2012). Labels containing nano-molecules or imprinted with bar codes can be scanned electronically. Others, such as RIFID labels, can be accessed using radio signals. Increasingly, data logging devices support data capture in the field for immediate or subsequent transfer to online databases. These devices can be handheld devices or integrated in existing machinery such as trucks and harvesting machines. Such technologies are more efficient than manual methods because they reduce the need for error-prone manual information transfer. Validation is also supported through the metadata automatically collected with each reporting event (e.g., who reported via the user-account, when the information was collected via the time stamp, and where was the information was collected via the GPS module in the device) (Baldwin, Markowitz, Koparova, Gerardu, & Zaelke, 2015).

"Big data" analytical strategies: "Big data" approaches are being used at international level to identify risk of deforestation in agricultural commodity supply chains. The Transparency for Sustainable Economies (TRASE) tool draws on publicly available production, trade, and customs data and modeling to trace commodity flows back to production landscapes while identifying the actors involved. It identifies individual companies that export, ship and import a given commodity and applies an enhanced form of material flow analysis to link them to specific production localities ("TRASE," n.d.). Initiatives like *Chain Reaction Research* also combine multiple data types (deforestation alerts, chain-of-custody and trade data,

corporate financial and governance data) to assess the exposure of individual companies to material financial risks within agricultural commodity chains (Graham et al., 2018). The *BVRio Institute* runs a due diligence and risk assessment system for Brazilian tropical timber trade. The systems draw from public traceability systems, registries of infractions and convictions, publicly available data on distribution and density of commercial species and spatial data from Global Forest Watch, the Brazilian Government and other NGOs use the system to identify logging permits reporting questionable or unrealistic volumes (BVRio, 2016).

Forensic methodologies: These are being used to query or verify claims around the origins or contents of agricultural, forest and wildlife products. For example, stable isotope analysis is used to determine origin and legality of food products and timber (Camin et al., 2017; Dormontt et al., 2015). DNA genetic analyses are used to bolster prosecutions for illicit trading of wildlife and timber (Janjua et al., 2017; Wasser et al., 2018). New wood identification tools are used by inspectors to screen suspect material in ports of entry and by scientists in the laboratory to generate prosecutorial evidence against entities accused of sourcing wood illegally. When a robust collection of physical reference samples has been gathered from the natural range of a timber species, these techniques can validate or invalidate claims about the content of a product or its source (Taylor et al., 2020).

Computational social science and natural language processing: These technologies provide systematic ways to study online interactions on media and text. By automatically translating, interpreting and geolocating text information available online (like local news and media), this technology enables understanding of social movements and creation of early warning systems for crises (Brandt et al., 2020). For example, the *GDELT Project* monitors global broadcast, print and web news from more than 100 languages on ongoing basis every day. It can be used to automatically identify issues and tag this information, putting structure around unstructured data. These databases can then be used for several problems. For example, several researchers have used this approach to create a map of environmental conflict in India (Gupta, 2019). WRI has piloted the creation of near real time for land-related conflict alerts in Brazil and Indonesia using the same approach. This information, if allied with efforts to track supply of soft commodities, can deliver important insights on potential disruptions of supply chains, further increasing their resilience.

2.2.4 Chinese experience of due diligence and traceability systems for commodities

Policy and practice on due diligence

In the context of soft commodity value chains, “due diligence” is a risk management process implemented by a company to identify, prevent, mitigate, and account for how it addresses environmental and social risks and impacts in its operations, supply chains, and investments. In China, the term “due diligence” appears in numerous policies and standards that call for systematic identification of environmental and compliance risks for financial purposes such as acquiring or maintaining listing status on stock-exchanges, acquisitions and mergers, and refinancing proposals.

However, there are currently no regulations in China that explicitly require companies to conduct due diligence in soft commodity value chains. Article 65 of the revised Forest Law (approved by the Standing Committee of the National People’s Congress in 2019) stipulates that individuals and enterprises “shall not knowingly purchase, process or transport illegally sourced timber from illegal logging or illegal deforestation”. The revision came into effect on July 1, 2020, however, regulations for implementation have not yet been issued.

In 2009, China and the UK launched a project to develop a system with simple and low-cost procedures to promote sustainable forest management in timber producing countries. Known as the *China Timber Legality Verification Scheme* (CTLVS), this project drew on international experience in timber legality verification and China's own forest management systems. The CTLVS framework includes the *Chinese Government-guided Timber Verification Scheme* (CGTVS) which applies to countries that have entered bilateral timber agreements with China and the *Chinese Association-guided Timber Verification Scheme* (CATVS) for application in countries without such agreements. CTLVS lays out basic principles, the content of bilateral agreements, implementation and management methods for timber legality verification, relevant institutions and functions, and supporting documents on timber legality and customs management methods. The International Trade Research Center of Forest Products of the State Forestry Administration has cooperated with the China Forest Products Industry Association to pilot the wood legality verification with enterprises in China to test the accuracy, practicability and operability of the system. The pilots private valuable learning that could be to assure compliance with Article 65 of the Forest Law or adapted for application to other commodities beyond timber.

Policy and practice on product traceability systems in China

The State Council and several ministries have released policy guidance on how to develop commodity traceability systems for key products. The *Opinions on Promoting Fair Competition in the Market and Maintaining Normal Market Order* states that "the Internet of Things should be used to build a traceability system for important products and form an information chain with traceable sources, destinations, and responsibilities" (The State Council, 2014). The Opinions of the State Council on *Promoting the Legal Business Environment in the Modernization of Domestic Trade Circulation* further defined the content and tasks of building, managing, and expanding a traceability system for important products (The State Council, 2015). The *Opinions on Accelerating the Construction of Traceability System for Important Products* lay out the main targets for establishing traceability systems for important products¹ (General Office of the State Council, 2015). The Opinions call for improvement in standards, laws and regulations, data sharing mechanisms, companies' awareness and implementation, and the public's recognition of traceability systems by 2020. The Opinions also highlight the different roles of companies, government agencies, industry associations, and third-party service platforms in traceability systems.

In 2017, the Ministry of Commerce and six other ministries² jointly issued the *Guidance on Promoting the Establishment of Information Traceability System for Important Products* (MOFCOM, 2017). The Guidance, building on the Opinions issued by the General Office of the State Council, sets the main tasks for establishing traceability systems for important products, including the establishment of a national traceability management system, coordinated traceability standards, data sharing and exchange, big data analysis, general investigations and emergency management. The Guidance specifies basic tasks and sector-specific tasks. In terms of basic tasks, it proposes to establish a catalog management system for important products at both the national and local levels, improve traceability standard systems, strengthen

¹ Important Products includes edible agricultural products, food, drugs, agricultural production materials, dangerous goods, rare earth products, etc. (General Office of the State Council, 2015).

² Other ministries include the Ministry of Industry and Information Technology, the Ministry of Public Security, the Ministry of Agriculture, the General Administration of Quality Supervision, Inspection and Quarantine, the General Administration of Safety Supervision, and the General Administration of Food and Drug Administration

certification and accreditation systems, promote interconnection between national, provincial, and municipal traceability platforms, promote integration with upgrades of company information systems, and strengthen supervision of traceability systems. The sector-specific tasks set priorities for different sectors mentioned in the Opinions above. For the food sector, it proposes to establish a national traceability platform compiling information about country and region of origins, production companies, brands, exporters or agents, domestic recipients, and import and export records in coordination with the necessary information for Customs as well as Inspection and Quarantine to achieve traceability from production to trade and consumption.

The Ministry of Commerce leads the development of a traceability system for important products in coordination with the Ministries of Finance, Industry and Information Technology, Agriculture and Rural Affairs, Market Supervision and others, so as to strengthen the whole process of quality and safety management and risk control.

From 2016, the Ministry of Commerce and the Ministry of Finance began piloting traceability systems for important products in Shandong, Shanghai, Ningxia and Xiamen, and completed the evaluation of these pilots in the second half of 2018. The pilot traceability systems were then expanded nationwide for products such as meat, vegetables, alcoholic products, and Chinese herbal medicines. Up to now, 58 cities in China have implemented traceability systems for meat and vegetables. 18 provinces and cities have the system for Chinese herbal medicine supply chains, and 8 enterprises in four provinces/ cities have piloted traceability for alcoholic products.

The idea of traceability systems has expanded through the pilot programs to cover other industries. "Establishing and improving the traceability system of dairy quality and safety in the whole process of breeding, processing and circulation" was written into the Opinions of the General Office of the State Council on Promoting the Revitalization of Dairy Industry to Ensure the Quality and Safety of Dairy Products. The State Food and Drug Administration has incorporated traceability into quality management standards for drugs. The Guiding Opinions on the Construction of Drug Information Traceability System propose "establishing a whole-course traceability system for vaccines" into the Regulations on the Administration of Vaccine Circulation and Vaccination. The Administrative Measures for Organic Product Certification features the need of a traceability system for product quality and safety as well as effective anti-counterfeiting and traceability technology in the certification process. The new version of the Implementation Rules for Organic Product Certification requires a product traceability system as a component of the organic product certification process.

Under the guidance of national policies, traceability systems for food, medicines, agricultural production materials, special equipment and other important products are developed at the provincial level. In some places, traceability systems support the recognition and promotion of products from impoverished areas. For example, Nanjiang County, Sichuan Province, a poverty-stricken county, established a traceability system for Chinese herbal medicines such as *Salvia Miltiorrhiza* (red sage) in 2017. The traceability system helps to verify the authenticity of Chinese herbal medicines from a region known for the quality of its products, and also creates a long-term incentive for local producers to expand the scale, quality and efficiency of their production systems.

In the context of COVID-19, the National Health Commission issued the *Notice on Further Improving the Traceability Management of Cold Chain Food* in November 2020 to reduce the risk of spreading the virus via refrigerated food (National Health Commission, 2020). The Notice required better tracing of cold chain foods, such as meat and seafood, from customs import inspection to storage and distribution, production

and processing, wholesale and retail, and catering services. The Beijing Cold Chain Food Traceability Platform was launched, in November 2020, and other provinces and cities soon followed. The platform requires businesses to upload data such as the source, destination, quantity and location of frozen meat and seafood products and trace their source and destination. As of June 2021, the traceability platform has stations in multiple provinces and municipalities connected and accounts for more than 90% of the country's imports. The remaining 10% of imports are traced by means of paper accounts and purchase vouchers, which are also administered by the government.

The main method to trace the source of goods is to create QR code labels or RFID tags that are affixed to the goods, scan the codes to record important information at each link in the value chain, and upload and save the information to the platform's cloud-based computing system. By scanning the code on a product, a system user can access information about products' origins and quality via the internet. The lower cost QR code label tends to be used more. However, if RFID tags are used, rich information can be written into the tags (which cannot be erased), and semi-automatic scanning can be achieved in production, packaging, warehouse, and other steps in value chains.

3. Accelerating Circular Economy throughout the Value Chain

Circular economy is not a new concept in China. Over the past 20 years, the country has made tremendous progresses in developing circular economy pilots, policies and national strategies. As of 2020, the last year of 13th FYP, China's circular economy development has achieved significant outcomes (Xinhua, 2021a). These include:

- The output rate of major resources³ increased by about 26% compared with that in 2015;
- The energy consumption per unit of GDP continued to drop sharply, and the water consumption per unit of GDP cumulatively decreased by 28%;
- The comprehensive crop straw utilization rate reached over 86%, and that of bulk solid waste was 56%;
- The comprehensive utilization rate of construction waste reached 50%;
- The capacity of processing and utilizing renewable resources⁴ has been significantly enhanced;
- The utilization of waste-paper was about 54.9 million tons;
- The utilization of scrap steel was about 260 million tons, replacing about 410 million tons of 62% grade iron-concentrate;
- The output of recycled nonferrous metals was 14.5 million tons, accounting for 23.5% of the total output of ten kinds of nonferrous metals in China, among which the outputs of recycled copper, recycled aluminum and recycled lead were 3.25 million tons, 7.4 million tons and 2.4 million tons respectively.

Clearly, incorporating circular economic models in the design of green value chains can improve resource efficiency in both domestic manufacturing and consumption and reduce raw material inputs and waste volumes along the entire soft commodity value chain. China has already established and piloted the within-the-industry, multi-industry and cross-industry circular economy models in industrial parks developed for key sectors including iron, steel, coal, chemicals, nonferrous metals and building materials. Circular economy practices have greatly improved resource efficiency and recycling rates for key materials, leading to significant pollutant and emission reduction and energy conservation. The country has also implemented circular economy practices along the value chains for pilot industries, covering renewable resources, solid waste, wastewater, residual heat, etc. For instance, some "urban mineral demonstration sites" have successfully incorporated recycling, sorting, depth processing, high value utilization, and harmless treatment in their product value chain. Product parts are dismantled and recycled to become feedstocks for future production. All companies within the industrial parks are connected to allow wastewater, residual heat and solid waste generated in the production processes to be reused and recycled in a close-loop recycling manner.

The same circular economy design principles can be applied to many soft commodity manufacturers to help green their value chains and broaden the application of circular economy pilots. In turn, the implementation of green value chains can reinforce circular economy development in China. In particular,

³ Output rate of main resources (yuan/ton) = GDP (100 million yuan, constant price) ÷ physical consumption of main resources (100 million tons). Major resources include: fossil energy (coal, oil, and natural gas), iron and steel resources, non-ferrous metal resources (copper, aluminum, lead, zinc, and nickel), non-metallic resources (limestone, phosphorus, and sulphur), and biomass resources (wood and grain).

⁴ In the 14th Five-Year-Plan, renewable resources refer to scrap iron and steel, scrap non-ferrous metals, waste plastics, wastepaper, waste tires, waste mobile phones and waste power batteries.

new technologies focusing on traceability and transparency in value chains can gather data that can also be used to improve the sorting of materials and identify end-users to further increase end-product reuse and recycle rates. Furthermore, global sustainability standards adopted by green value chains can be applied to verify and track internationally traded recycled materials and reused products.

As described in section 1.4 and despite the achievements made, China still faces major challenges for upscaling the circular economy. Accordingly, this part of the study explores the potential to green the production and consumption parts of the value chain, where commodities are made into food and material products and used by consumers. It focuses on the concept of circular economy, defined for the purpose of this study as a new way to design, make, and use things within planetary boundaries. It involves a holistic approach to value chains that focuses on designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.

While this study is focused primarily on soft commodities, once a commodity moves into the production, consumption and recovery stages of the lifecycle, soft and hard commodities are often combined. Examples include plastic packaging of food, or metal-framed and textile covered furniture. Thus, a holistic treatment of circular economy necessarily involves issues concerning hard commodities.

3.1. Why embracing circular economy is important for greening value chains?

Box 8. Key takeaways – the importance of circular economy for China and greening value chains

- Circular economy practices will be needed to reduce pressure on upstream soft commodity production by cutting raw material inputs in production through reduce, reuse and recycle (the 3Rs). These practices offer the added benefit of significant emissions reduction to contribute towards China’s carbon neutral commitment.
- Circular economy approaches are consistent with reaching sustainable development goals within planetary boundaries and are a catalyst to innovation that presents business opportunities and competitive advantages for countries and for businesses that embrace it. Such approaches include green consumption and lifestyles, sustainable procurement, product sharing platforms, products as a service and secondary markets.
- Of the 3Rs, reduce is the most impactful, followed by reuse and then recycle. Reduce starts with influencing customs and habits. This aligns well with Chinese holistic approaches and with the aspiration of ecological civilization. However, innovative policy and financial instruments are needed to accelerate the social transition by influencing, regulating, and incentivizing the uptake of more sustainable practices at scale.
- Circular economy practices are prevailing in major developed countries at the consumption end of global value chains. As the world largest exporter, there is a big global trade opportunity for China, but one that needs to be nurtured and supported by policy. Chinese policymakers must stay open-minded to constantly update policies to track and where relevant, lead global circular economy trends and by drawing on international experiences.

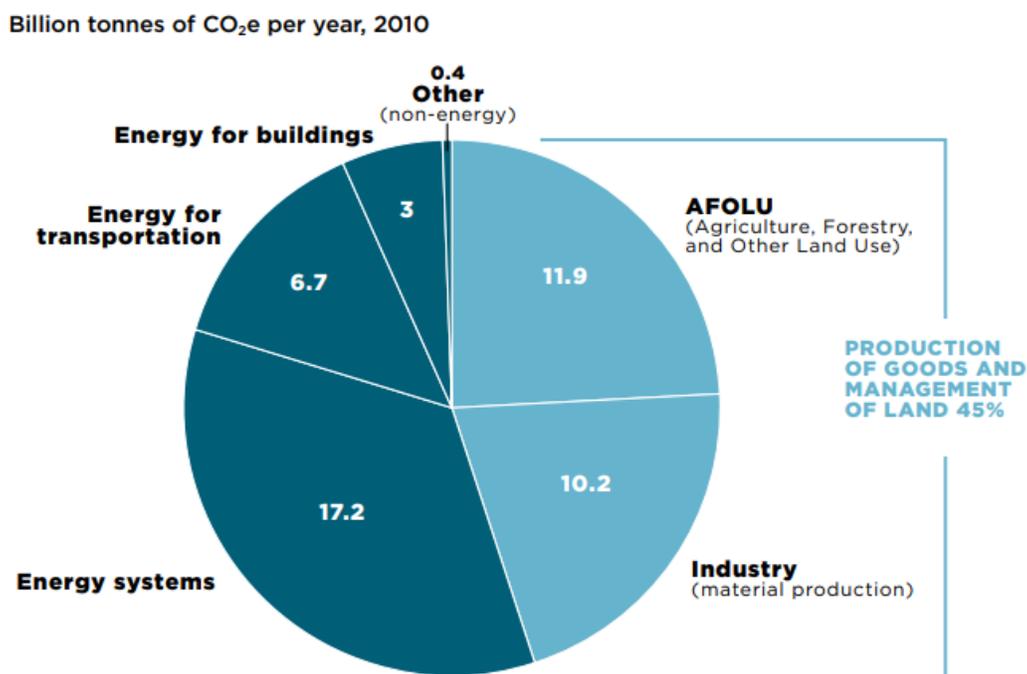
3.1.1 The potential of a circular economy at global level

Global adoption of a circular economy could help reduce global greenhouse gas emissions by 39%, primary material consumption by 28% by 2030, compared to a 2011 baseline (Haigh et al., 2021), and reduce the flow of plastic waste into the ocean by 80% in 20 years (Reddy and Winnie, 2020). The economic benefits are also promising. Transitioning to a circular economy could close the global gap of eight billion tons

between the supply and demand of natural resources, which is equivalent to USD 4.5 trillion of economic opportunity by 2030 and US \$25 trillion by 2050 (Accenture, 2015), add 6 million jobs by 2030 and help to retard the USD 13 billion in costs and economic losses driven by plastic pollution each year (UNEP, 2014).

Approximately, 45% of global GHG emissions are generated from the extraction and processing materials and from the management of land – see Figure 4. (Ellen MacArthur Foundation, 2019a). Agriculture is central to a large proportion of these emissions: the global food system (including agricultural production, processing, and distribution) emits 16 gigatons of CO₂e annually (FAO, 2021); and 23 percent of the 1.6 gigatons of CO₂e per year emitted by the textiles industry, is attributed to growing cotton (Ellen MacArthur Foundation, 2017; WWF, 2013).

Figure 4. Global GHG emissions by sector - 45% can be attributed to the production of materials and management of land.



Source: Ellen MacArthur Foundation, 2019a.

The three “R” concepts of circular economy are “reduce, reuse and recycle”. REDUCE is the absolute reduction in demand due to reduced purchases by the buyer. It can be achieved in multiple ways including waste reduction at all stages in the value chain. It is important to note, however, that ‘reduce’ is explicitly linked to manufacturers and their role in the pre-market stages of the Concept and Design Life Cycle, stressing using less material per unit of production. REUSE is the repeated and optimized utilization of a product in its manufactured form, ideally for its originally intended purpose and failing that for a lower value purpose. The process of reuse involves multiple stakeholders, from consumers, to collectors, retailers and producers. RECYCLE is the reprocessing of individual material components of a product making them available as raw materials to substitute for virgin raw materials. Recycled materials without any of the original product structure are also known as ‘secondary’ materials and can be re-applied anywhere (Reike et al. 2018).

Applying a circular economy approach to key materials such as cement, aluminum, steel and plastics can eliminate 3.7 billion tons of CO₂ by 2050. Additionally, circular economy strategies in food systems such as shifting to more nature-enhanced farming systems and making more effective use of the already produced food could reduce CO₂ emissions by another 5.6 billion tons by 2050. This would be equivalent to cutting all transport emissions to zero (Ellen MacArthur Foundation, 2019a).

3.1.2 What is the significance of the circular economy for China?

Research shows that a full embrace of the circular economy has the potential to save Chinese businesses and households roughly CNY 70 trillion (US \$11.2 trillion) by 2040 in spending on high-quality products and services, approximately 16% of China's projected GDP. It can also improve the health and well-being of the Chinese population in cities by reducing greenhouse gas emissions by 23% and the haze-inducing fine matter particulates by 50% (Ellen MacArthur Foundation, 2018a).

With prevailing circular economy practices in major developed countries at the consumption end of global value chains, the need for Chinese manufactures to meet the growing demand for sustainably produced products elsewhere will also reinforce China's efforts in greening global value chains for soft commodities. Central to this shift is China's broader relationship with the world. Already with a well-established framework for circular economy – epitomized by its 2008 Circular Economy Promotion Law – China can continue being a leader in this space by evolving its policies to keep pace with global circular economy trends and by learning from international experiences. Such trends can help to raise the ambitions of Chinese circular economy practices – moving beyond industrial strategies to ones inclusive of sustainable consumption. Already, through the 2018 China-EU Memorandum of Understanding, China has forged an alliance with the EU to exchange policy ideas to align key circular economy mechanisms, product standards and systems. Such collaborations can help to boost widespread adoption of innovative circular economy practices and support the development of a global low carbon economy (Ellen MacArthur Foundation, 2018). Additionally, there is great opportunity to enhance China's trade relationships around the world. Reframing these relationships in light of circular practices presents an opportunity for win-win collaborations with environmental, economic, and social benefits.

Bundled together, the mandates from its *14th Five-Year Plan, Six Securities* and recent *2030/2060 carbon commitments* can largely be tackled by fully embracing circular economy. This will set China on the path to achieve the economic, social, ecological, and environmental targets laid down by the 14th FYP, which are crucial for the post-COVID economic recovery in the near term as well as for the realization of the Chinese dream in the medium- and long-term (CCICED, 2020).

3.1.3 Circular economy can make a significant contribution to China's 2060 carbon neutrality goal.

Clearly, reducing the use of materials can significantly contribute to carbon emission reduction. This is particularly the case for China – the world's largest manufacturer of steel (57% share of global production), plastics (25% of global production), and cement (51% of the world's production) (Ritchie & Roser, 2018; Garside, 2021; Zhang, 2021). Finally, greenhouse gases (GHGs) emissions from the Chinese agrifood systems should not be ignored, accounting for 1.09 billion tons CO₂eq or 8.2% of the total GHG emissions of the country in 2018 (Fan et al., 2021). Hence, reducing food loss and waste could significantly cut emissions from the agrifood industry. Examples of how circular economy measures can reduce emissions are presented below.

Firstly, raw materials as production inputs can be reduced through improved product design and production processes that allow for minimized use of raw materials, increased use of recycled materials to replace raw materials, and increased longevity of products. In this regard, innovations are needed to improve the efficiency of the mechanical recycling of materials. For example, Apple uses its own designed AI robot Daisy to disassemble 15 different models of iPhones automatically in a speed of up to 200 devices per hour. This innovation makes it possible to recycle more materials in end-of-life iPhones with downstream recyclers. Currently, in the latest iPhone model, there are many recycled materials used in different models including 100% recycled rare earth in the magnets, 100% recycled tin in the main logic board solder and 100% recycled tungsten in the Taptic Engine etc. (Apple, 2020; Garrison, 2020).

Secondly, the use of raw materials can be reduced by preventing and reducing material loss and waste in production, processing, distribution, and retail. Currently, more than 6% of China's total food production (or 35 million tons) are lost and wasted in China (Marchisio,2020). Cutting food loss and waste per year has the potential to reduce demand for 13 million hectares of agricultural land (“liberating” marginal agricultural land to rebuild the country’s carbon sink via reforestation), significantly decrease fertilizer pollution (reducing emissions of the N₂O) (Fang, 2020) and taking pressure of agricultural production off nature.

Thirdly, and equally important is reducing consumption, which can effectively reduce the total demand, leading to lower production outputs to match it. This requires a major shift in our current consumption model by reducing consumer food waste, encouraging sharing economy, and increasing the use rates of products through secondary markets and rental markets. Together, these measures can extend the lifespan of products, lowering the demand of material input for the manufacturing of new products, which can subsequently reduce the upstreaming production pressure and emissions generated during production.

From an emission reduction perspective, reusing products can conserve the energy embedded in the resources and processes used to produce different products. Consequentially, the more a product is reused, the bigger the avoided emissions and economic savings are, by refraining from using the otherwise needed resource to produce new products. Additionally, this would avoid the emissions derived from the end-of-life processing of these new products, such as disposing them in a landfill or incinerating.

After product reuse, materials recycling is the next priority. Emissions reduction potential through recycling varies by materials. Table 2 below presents the GHG inventories of different materials in primary and secondary production⁵, indicating clear potential for CO₂ emissions reduction through recycling. Notably, aluminium is among the materials with highest potential for emission reduction when being recovered, followed by steel, plastics, glass, paper and cardboard. This suggests that the recycling of some materials can lead to 3 times more emission reductions than others and therefore should be prioritized for climate mitigation strategies. However, evidence also suggests that not all materials can be indefinitely recycled. For instance, elements such as aluminium, glass and metal can be recycled over and over again without suffering any structural change, whereas plastics can be recyclable on average up to 3 times. During this process, plastic loses its structural property, therefore could only be used for lower value products before being disposed in landfills (Holmes, 2017).

Table 2. Comparing CO₂ emission reduction potential across different materials

⁵ Primary production refers to production using raw materials as input in the process, whereas secondary production refers to the usage of recycled elements as input in the process.

Material	Primary production (Kg CO2 eq/ Kg material)	Secondary production (Kg CO2 eq/ Kg material)	Emission reduction potential through recycling (Kg CO2 eq/ Kg material)
Glass*	0.9	0.5	-0.4
Aluminium*	11	0.4	-10.6
Steel*	2.4	0.3	-2.1
Plastic*	2.1	1.3	-0.8
Paper and Cardboard*	1.1	0.7	-0.4
Cotton**	11	4.3	-6.7

Source: *Hillman et al. (2015); ** Liu et al. (2020)

3.1.4 Circular economy principles allow producers to contribute to China’s Dual Circulation policy while reducing pressures on nature resources

In 2019, domestic demand accounted for 89 percent of China’s economic growth, and final consumption expenditures contributed to 58 percent to GDP growth (CCICED, 2020). As we approach the natural and mineral resource boundaries of the planet, current consumption patterns will not be sustainable and will be a brake on growth unless other patterns for demand generation can be found. The growing middle class and the increased population of younger “netizens” have created just such an opportunity for the upgrading and green transition of China’s consumption toward more sustainable consumption patterns and sustainably sourced and produced products. Focusing on promoting green consumption in China, circular economy practices can provide practical solutions to continue growth without coming up against resource limits.

More specially, from a production viewpoint, a new circular economic model will improve the circularity of materials by reinforcing the 3-R from the design to production, improve resource efficiency, reduce the impact of production, and subsequently improve the environmental quality and human health. For instance, with consumers becoming ever more concerned with sustainability and eco-friendly formulas, beauty brands such as *Lush* launched its first “Naked” shops in 2018 where solid soap and shampoo bars have completely eliminated the plastic packaging by redesigning the products according to eco-design principles. Other companies have started to follow suit. In 2019, Marks & Spencer started to trail over 90 lines of loose fruit and vegetables completely free of plastic packaging at its Tolworth store and expect to save 580 tons of plastic waste over two years. Moreover, trained greengrocers were introduced to offer customers advice on the selection and preservation of fruit and vegetables to avoid food waste at home (Sustainable Brands, 2019). Today, zero waste lifestyle has begun to emerge across Europe. For instance, in the UK alone, over 100 zero waste stores are offering opportunities for plastic free shopping (Bracken, 2021).

Further down the value chain, circular economy can also promote green consumption and foster green lifestyle through sustainable procurement, sharing platforms, products as a service, secondary markets and the like. Reuse models extend the lifetime of products and reduce upstream pressure on production. Meanwhile, the increasing demand for quality and sustainable products in the domestic market will also accelerate the adoption of sustainability, and/or safety standards on imported raw materials, which

reinforces strategies to green global value chains. Below, we present a few concrete examples to illustrate how circular economy could support China's dual circulation policy.

Reduce the use of unsustainably sourced raw materials to meet the increasing domestic demand for green consumption in China

Purposeful design is one of the guiding pillars of the circular economy. With around 80 percent of a product's future environmental impact determined in the design phase (Ellen MacArthur Foundation, n.d.b), carefully sourcing and use of materials for quality, durability and health is key. Good design can incentivize consumer behaviors that promote repair, reuse, and recycling of products, whether it be through longer ownership, service-based models of use, or repurposing a material. Consequently, this can lead to reduced raw material usage for production. In some cases, lifting design standards as requested by legislations or certifications can also accelerate the process to green value chains, and increase resource efficiency and sustainable sourcing to reduce the overall environmental impacts.

Taking eco-design as an example, the concept is not new, but the challenge lies in incentivizing producers and manufacturers to kick start the circular value chain. Countries around the world have already developed legislation and certifications that aims to promote eco-design. In Europe, for example, the Eco-design Directive provides design guidance on products made in the EU that impact energy consumption, such as heaters, water-using devices, and insulation materials. This measure is estimated to save 167 TW hours of energy savings per year by 2030, equivalent to the annual energy consumption of Denmark (European Commission, 2019). France has taken this framework one step further with its 2020 Circular Economy Law, which proposes strict provisions on right to repair, rules around the destruction of unsold goods, and waste management. The law would, for example, require producers and importers to inform consumers of their products' environmental attributes, from recycled content to possibilities of reuse (Sauvignon, 2020). The EU has recently updated its Eco Design Directive to also cover the longevity aspect of the product design. It requires that spare parts of a product need to be available on the market for a longer time to allow for repairs in an easy and accessible manner (European Commission, 2019).

As an early proponent of the circular economy, China has traditionally focused on end of pipe waste management, pollution prevention and cleaner production. But in the recent 14th FYP for circular economy development, Chinese government has made it clear that improving the standard system of circular economy and specifications of green designs will be a priority for the next five years. By transitioning to a more systemic model that, among other things, encourages smart eco-design, China can continue to manage these issues while aligning with the holistic approach to circularity. Similarly, the promotion of green buildings in urban areas sets an example to reduce environmental impacts through good design. To curb greenhouse gas emissions from construction and reduce its impacts on natural capital and biodiversity throughout the value chain, the Chinese government has recently imposed more stringent regulations on real estate. This was made clear in China's 13th five-year plan, which requires that by 2020, up to 50% of the newly constructed buildings in urban areas must meet green building standards and up to 40% of construction materials must be green. Meanwhile, the number of people interested in purchasing green homes has grown three-fold in China between 2012 and 2017 (Loupan, 2018).

New regulations together with the shift in consumer behavior has started driving the transition to green buildings that use more sustainable construction materials. It led to the creation of the "Green Supply Chain in Real Estate Industry in China" initiative in 2016, which is a business alliance of key stakeholders

including real estate companies and the upstream (e.g., building construction, construction materials manufacturing) and downstream sectors (e.g., furniture manufacturing) to develop joint actions towards greening value chains (GSC, 2015). As of 2019, it has involved 100 real estate companies and 3,669 whitelisted domestic and international suppliers. The annual sales of these enterprises are valued at US\$290 billion, accounting for about 20% of the total industry in China (GSC, 2015).

Since its inception, the Initiative has achieved notable success. It made significant contributions to improving legal and responsible sourcing of timber in the Chinese real estate sector by incorporating a “White List” standard into the joint procurement bidding documents endorsed by all member companies since 2018. With technical support received from the Global Forest & Trade Network, the joint procurement policies clearly state that green timber materials must not be sourced from forests with high ecological value, from tree species listed by the Convention on International Trade in Endangered Wild Animals and Plants, from forest areas without clearly established tenure rights, from areas undergoing forest and agricultural land conversion, or from genetically modified timber. This effort has led to approximately US\$28 million of wood flooring being procured (22% of China’s total market) from legally logged forest land, which represents an important effort in forest conservation and eliminating the negative biodiversity effects of timber harvesting (GSC, 2015). By 2025, the initiative aims to expand this effort to shift over 50% of Chinese flooring companies to using FSC certified timber, bringing over 5 million ha of forest under sustainable management and contributing to global biodiversity conservation efforts (WWF China, 2015).

Focusing on high-quality design will allow Chinese companies to better address the increasing green consumption in the country while reducing the use of unsustainably sourced materials and environmental impacts. However, Chinese government must ensure a well-functioned monitoring and evaluation system in place to support the market transition. For instance, it can develop a mechanism to certify the green value chains which could incorporate other well-established global certification schemes and sustainable standards such as the FSC certified timber. Additionally, strengthening the relevant regulations and law enforcement is also important to obtain expected outcomes.

Reuse business models powered by digital solutions can fuel China’s economic growth within resource limits

Reuse of products allow for diminished resources consumption; one emerging business model is the sharing economy model which has many concrete applications including shared mobility, garments, power banks and so on. It entails the temporary use of goods and services which can be achieved through private individuals or companies owning the product and providing it as a service to consumers. Ultimately, the environmental benefit derives from an increased utilization of different goods and assets as well as their extended lifetime, which can conserve the embodied energy and other value resources and avoid GHG emissions associated with new material productions and end-of-life treatment (Ellen MacArthur Foundation, 2019b).

Taking the fashion industry as an example, the sharing economic model has seen growing popularity over the past decade, especially for designer products, including garments, shoes and accessories that are occasionally used by the middle classes in special social events. For instance, in 2009, “Rent the Runway” emerged as an e-commerce platform that allows users to rent, subscribe, or buy designer apparel and accessories. Since 2016, the business has started scaling drastically by accelerating the subscription business and became profitable. As of 2019, the company was valued over \$1 billion (Segran, 2019). Such a business model is replicable for Chinese market and could have even bigger business potential for the

rapidly growing middle class, which expects to grow from 57% of the economy in 2015 to reach 75% by 2030 (GMA, 2021). In fact, similar concepts have already started to emerge in China since 2014, including MsParis, Y-Closet, Yeechoo, Starluxe, Yiqidai, and Dou Baobao (Forslund, 2019).

Meanwhile, the luxury market is expected to expand and grow as the Chinese avidly embrace new lifestyles and new consumption habits. This rapid growing demand can be partially met through the sharing economy, whose transaction volume is expected to grow 10 percent annually from 3.38 trillion yuan (\$522.47 billion) in 2020 (Ministry of Information Industry 2021). Furthermore, e-commerce will expedite the online sales of luxury brands to reach the Gen Z from outside the first-tier cities, as 80% of Chinese prefer to buy online when it comes to luxury (GMA, 2021).

Finally, reuse can also occur through secondary markets to buy a used item of apparel or furniture. Whereas rental works well in luxury markets, reselling as a form of resale currently works better in mid markets. Chinese e-commerce giant Alibaba Group runs a resale consumer marketplace called Xianyu, where users can buy and sell second-hand products and use the parent company's logistics system if they choose.

All in all, creating new sharing economy and reuse models can increase the use rates of products. This will not only meet the increasing domestic consumptions for high-quality life, but also drive the growth of new demand without increasing production, hence less demand for raw material extraction as production input. This serves the engine to power high-quality development and green growth as noted in the 14th FYP.

Despite these important benefits, the possible rebound effects (or Jevon's paradox) of sharing economy should not be ignored. Here, rebound effect refers to the reduction in expected gains from increased efficiency of resource use through shared products, because of behavioral changes toward an increasing demand of product sharing, which may diminish the beneficial effects. Sharing economic model makes it cheaper for consumers to rent a luxury item than owning one, which collectively may increase the demand for these products. To minimize the risk of unintended rebound consequences, right policy incentives would be needed to guide the development of healthy consumption habits.

Increase recycling as an alternative solution to meeting the growing domestic consumption

While keeping products and materials in the economy through reuse, that which cannot be reused can still retain value through recycling. Increased recycle rates of wood-based materials can also help China as an importer to reduce dependence on the imports of timber, which will take pressure off tropical forests. This can be done through interventions in the building construction, furniture manufacturing and paper industries.

The Chinese real estate sector is the fourth largest in the world in terms of market value (US\$540 billion) (Teuben & Bothra, 2018). It is also expanding the fastest, with China adding 2 billion m² of floor area each year in its rapidly growing cities (Huang et al., 2018). Additionally, China's real estate sector will expand its construction business overseas through the Belt and Road Initiative. This continuous expansion has important environmental implications both domestically and internationally.

Currently, construction and furniture manufacturing industries accounted for 51% of China's timber consumption in 2019, of which 60% was imported (Research and Markets, 2018). The consumption and total import volume of timber in China is expected to grow to meet increasing demand. However, a national restriction on logging makes it even harder for China to meet its needs for timber through national

sources. Consequently, the market for reclaimed wood as material for flooring has been rapidly growing. While this reduces pressure on upstream production, the Chinese government must complete and strengthen the regulations on the use of reclaimed materials to minimize potential risks to human health. This is because the presence of hazardous substance during the production phase will remain in the recovered materials. Some countries have already developed policies to regulate the recycled materials to avoid negative health impacts. For instance, the biocide regulation of the European Union (528/2012) clearly prohibits the presence of hazardous substances such as formaldehyde resins on wood-based panels.

China has been the world's largest paper since 2010, accounting for 25% of the global production (Boqiang & Moubarak, 2014). The consumption of paper has grown massively over the past decade, largely driven by the booming of e-commerce and associated packaging. In 2017 the industry processed 40 billion orders, which implied 100 million parcels each day, and 7.9 million metric tons of packaging waste. Of it, 86% were scraps of corrugated paper, while plastics represented 3.6 %. The current demand of virgin fibers for paper production cannot be met through national sources (Shang, et al., 2021).

A clear solution lies between sourcing timber internationally and increasing paper recycling rates. However, the former has significant local impacts in the sourcing countries. Consequently, circular practices focusing on recycling could allow China as a buyer country to reduce the pressure on countries with large deforestation fronts (Pacheco, et al., 2021). Recycling has a huge potential in meeting the continuous growing demand for paper. For instance, 60% of paper packaging and almost the totality of plastics was not recycled in 2017 (Duan et al., 2019).

However, while increasing recycling rates is crucial, solutions on the production side alone do not address the deep-rooted problem of our current unsustainable growth model: the unsustainable expansion and growth of consumption driven by the rapid growing population and income. An alternative approach is, therefore, eliminating paper and cardboard packaging altogether and replacing it with reusable containers and a comprehensive reverse logistics system. The latter will also require the shift of existing consumption pattern. A good example of this is RePack's business model. The company operates as a provider of postal packaging products to online stores. Consumers can opt for RePack's packaging service and are offered a voucher once they send the packaging back by post. While consumers can make use of the voucher with any other online platform, retailers can align themselves with environmentally sound delivery services and create loyal customers that seek to reduce environmental impacts in their everyday life. This allows RePack's to reduce 80% in the carbon footprint as compared to disposable plastic packaging (SITRA 2017b).

3.1.5 Circular economy practices focusing on sustainable consumption can set the foundation for high-quality development

Equally important, the 3-R concepts of circular economy can be applied to accelerating the shift of consumers' behavior toward a "reduce and reuse" model. This will cut the need for raw materials while increasing the demand for products that are made from recycled materials, which will, in turn, reduce the need for imported raw materials that are used as production inputs. Examples of such consumption-based strategies are set out below.

Shift the consumption model to reduce food loss and waste and the use of plastics

Food loss and waste (FLW) is increasingly a major challenge for China. It accounts for approximately 35 million tons of food annually, or about 6% of the country's total food production, an amount that could feed between 30 and 50 million people (Marchisio, 2020). Roughly half of FLW occurs at the downstream

end of the supply chain, whether it be in retail stores or at the hands of consumers. Restaurants and canteens present on average a 28% of the FLW (Liui, 2014). In the meanwhile, China is facing shrinking arable land for growing food, largely driving by land degradation - about 40% of its soil already moderately or severely degraded (Patton 2014). This means China must address FLW through consumption to increase food security and reduce pressure on agricultural expansion.

Efforts are already under way in China to address the issue. In 2020, President Xi announced the Clean Plate campaign, which encourages consumers to order less at restaurants (BBC, 2020). Furthermore, China's new food waste law will impose a fine up to 100,000 yuan to anyone who promotes overeating on popular social media channels such as binge-eating videos. Restaurants will also face fines if they induce or mislead consumers to 'order excessive meals and cause obvious waste' (Zuo and Cai, 2020). In response to the campaign against food waste, local-led efforts have been implemented across China. For instance, since April 2020, Jinling Grand Hotel in downtown Hefei started to reward diners a 10 percent discount or a 50 yuan (US\$7.19) coupon to use on their next visit if they take away their leftovers (Xing et al., 2020).

However, more innovations are needed to promote a change in people's customs and cultural attitudes that will reduce wasteful food consumption habit and encourage healthy diet (Zuo and Cai, 2020). For instance, policy incentives or new business models driven by technology can nudge retailers to sell food that would otherwise be wasted at a discount. For instance, to deal with an uncertain and fluctuating demand, Lunchie and ResQ created a market-place via a mobile app, which allows catering locales to sell surplus food at a discounted price to local customers who can pick up food at specific time windows. This app provides a win-win solution to consumers who can easily access to high quality food at lower price, and to local restaurants who can avoid food waste and associated revenue loss (SITRA, 2017).

In addition to food waste, single use of plastics also urgently needs to be tackled. China produces around 20 million tonnes of single-use non-biodegradable material annually, including 3 million tons of shopping bags (BBC, 2020). Policy innovations are urgently needed to nudge citizens towards lower consumption of plastic packaging. On 16 January 2020, China announced a ban, jointly issued by the National Development and Reform Commission (NDRC) and the ministry of ecology and environment, on single use plastics in restaurants, shopping plastic bags, and cosmetic products containing microplastic. The ban has come into effect on January 1st, 2021 (Zhang, 2021), expect to reduce plastic use in takeout in the cities by 30% by 2025. The effectiveness of the policy is yet to be seen, but provinces throughout the country have since issued their plans for implementing the national policy.

Meanwhile, research in substitute products to replace plastics is also on the rise. For instance, fast-food restaurants started to offer *Bakeys* spoons, forks, and even chopsticks that are made of sorghum, rice, and wheat flour. *EnviGreen*, an Indian company invented store bags made of starch that can become food for animals after use (Byrnes, 2019). There already exist many inventions that have been commercialized. They provide consumers with more options to replace plastics and therefore support behavior shift toward reduced plastic usage.

Shift consumers' behavior to encourage the reuse of plastics, reducing the need for raw material inputs.

Reuse models are a clear example of how circular economy can lead to a reduced need for raw material inputs, bringing along economic and environmental benefits. For Example, at a global level, the reuse of

20% of the total plastic would generate economic benefits for USD 10 billion (Ellen MacArthur Foundation, 2019a).

Packaging reuse is of great importance to China. Its citizens generated 60 million tons of plastic waste in 2010 alone (Albert 2020). At the same time, China is a major manufacturer of plastics as well, producing 20% of the world's plastics (Wang et al. 2019). During the COVID-19 pandemic, plastics production soared due to the increased demand for personal protective equipment and single use plastics like takeout containers and packaging for online purchases. By addressing the production and use of plastic, China would also be able to reduce fossil fuel consumption and imports, important raw materials for plastic production (Barron, 2020).

There are four practical ways to encourage plastics reuse at the end of value chain through a B2C (business to consumer) service model. Firstly, consumers can refill plastic containers at home using refills that are delivered based on a subscription service. To bring this new business model to scale, it requires that leading companies should come together to redesign and standardize their containers. For instance, *TerraCycle*, a social enterprise based in the US has developed a Loop platform that aims to change the way the world shops with favorite brands in refillable packaging offered with convenience and style. Secondly, business could provide a pickup service to refill the container and return it to the customer. Thirdly, consumers could opt for refilling containers at shops and other retail locations. Finally, consumers could opt for disposing their container at specific locations from which businesses could later pick up, clean and refill; making the product ready to be sold again at retail shops. As an example, *Splosh* shampoo is provided within a container that allows to be reused up to 20 times. As a result, 95% of material usage is avoided as well as the energy required in the production process of the plastic container (Ellen MacArthur Foundation, 2019b).

All in all, the benefits of reuse models for plastic containers are beneficial from an environmental and economic point of view. At the same time, they are diverse and can be implemented in different manners, being it applicable to a vast array of products. However, to upscale the reuse model, governments and businesses will need to create incentives to attract more consumers to participate.

Shift consumption to lead new fashion trends that promote the use of ecofriendly materials

The textile industry creates significant environmental impacts through the production, extraction and utilization of raw materials for natural fiber production. For example, cotton, accounting for 43% of all the fibers used within the European market, is characterized by a high-water footprint. The production of wool, another important material for fiber, generates significant GHG emissions (Šajn, 2019).

As consumers become more aware of how dirty the fashion industry can be, they have taken action to demand more from the industry. Consumer demand for more sustainable consumption can drive improvement in business practices and foster new sustainable fashion trends to emerge. For instance, the iconic luxury brand Hermes teamed up with American start-up *MycoWorks* to recreate its popular *Victoria* duffle bag using Sylvania, a material made from mycelium or mushroom roots (Lutze, 2021).

Additionally, the scarcity of raw material has forced many brands in the fashion industry to make use of recycling to meet the increasing demand for clothing. Over the past years, "Fiber to Fiber" as a sustainable alternative to raw material has already begun to emerge. However, the practice of recycling fibers to be used as input in new products is in its initial phases and hard to achieve the economy of scale. Shifting consumer demand can lead to increased investment in technological innovations that will address the

transformation suffered by fibers during the recycling process, such as shortening lengths, the current use of blends of fibers for garment, and other substances involved in the production process. Moreover, a change in consumer preference can also drive the increasing use of recyclable and recycled materials in fashion design, contributing to the sustainable transition of the fashion industry. For instance, Muiccia Prada's and Raf Simons's collaboration collection started to produce garments made from 100% recycled nylon (Lutze, 2021). H&M, in partnership with the research institute HKRITA in Hong Kong, developed a technology that can separate cotton from recycled polyester fibers without damaging them. The recycled polyester has then been used for a children's clothing line, contributing to the company's emission reduction target (Tanuvi, 2021).

As the world's largest textile cloth manufacturer, China can be greatly affected by changes in domestic and international consumption patterns. Greener consumption style is already gaining traction, especially among the middle class. Today, consumers are becoming more aware of the environmental impacts of textile production via social media, campaigns and peer influence and are willing to pay for more sustainable lifestyles. China's central and local governments can also support the transition to sustainable consumption through green public procurement. In the Netherlands, for instance, the Ministry of Defense specified a preference for recycled fibers in a large contract for the supply of towels, clothes and overalls (Ellen MacArthur foundation, 2017). Designers also have an important role in integrating recycled materials in fashion design, which can create fashion trends that also support the transition to green consumption and a healthier lifestyle within the planetary boundaries.

3.1.6 Circular economy can spur new business opportunities for Chinese enterprises

The influence of evolving global trade dynamics and policies on Chinese enterprises

As countries continue to build their interest in the circular economy, global trade policies and practices also need to be designed with circularity in mind. This important reframing to how countries think about trade is rife with opportunity. While circular economy transitions have historically been driven through domestic policies such as those mentioned in the previous section, it is increasingly evident that trade is also important since most goods are linked in some way or another to global value chains (OECD, 2018). And as a dominant force in global trade, it is critical for China to be cognizant of the economic, environmental, and social implications of cross border flows.

Within global trade dynamics, individual countries can set policies that bring circularity into international trade. Extended Producer's Responsibility (EPR) policies, for example, require producers to take responsibility for the products they bring into the beyond the consumption stage of the products lifecycle. EPR policies are often applied to products sold domestically but can also be extended to exported products. Producers would then become responsible for the collection, sorting and after use recycling of the goods in countries to which they are exported (Schleicher, 2021).

Industry-wide initiatives related to circular economy will also usually require supporting trade policies and practices to succeed. For example, by prioritizing eco-design, an industry can reduce waste through better product design, and make it easier to disassemble the parts of a product for reuse or recycling. Such practices, however, need "demand pull" to drive the supply. Countries can use trade regulations to generate such demand, along with harmonized standards, in multiple cross-border markets.

Global trade designed with circularity in mind provides benefits beyond the environment such as economic diversification, technological growth and innovation, and new skills development (Wellesley, Preston, and Lehne, 2019). If well-regulated, trade can move waste and materials to destinations that have better capacity to sort and process them (OECD, 2018). Open markets can be a powerful tool for good, and well-considered trade policies can reap positive commercial benefits. China can find greater security and stability in its supply chains by approaching trade and the circular economy as an interlinked system. Furthermore, as the trade in services is increasingly gaining more tractions than goods in global trade, this will create new circular economy business models in China, especially for small or micro-sized tech firms. For instance, the most-traded services related to the circular economy include: IT services, other professional, technical, and business services (such as technical testing or environmental consulting services), leasing or rental services without an operator, R&D services, maintenance, repair, and installation (except construction) services, sewage and waste collection services and professional services related to construction services (Tamminen, et al. 2020).

Additionally, China has a significant opportunity to assume leadership in issues of trade and circular economy, especially since the linkage between the two is still in its infancy. China can, for example, leverage the global market as feedstock for recyclable or reusable materials while simultaneously encouraging a shift in consumption habits among its 1.4 billion citizens. Additionally, plurilateral collaboration can benefit the health of intra-country relationships and extend beyond trade to other matters. China has already embraced a spirit of global cooperation, illustrated for instance, through its recent spearheading of the plastics initiative through the World Trade Organization. Today, majority of goods are linked in some way or another to global value chains (OECD, 2018). And as a dominant force in global trade, it is critical for China to be cognizant of the economic, environmental, and social implications of cross border flows.

The booming circular economy market and business innovations in China

Circular economy business models have already begun to emerge in many economic sectors in China. Many of them have generated considerable market revenues and create decent job opportunities to many.

(i) The opportunities of the sharing economy and service provision. As previously mentioned, sharing platforms, and products as a service, bring along environmental benefits, but also economic opportunities. In China alone, the sharing economy supported US \$500 billion in transactions by 600 million people in 2019 – anticipated to represent 20% of China’s GDP by 2025 (Campbell, 2018). Of the 0.76 billion people participated in sharing economy in China in 2018, about 75 million were service providers (iiMedia Research, 2019). In 2020, the size of the sharing economy workforce reached 84 million, of which 6.31 million were directly employed by online sale platforms (Ministry of Information Industry 2021). Expanding the sharing economic model to include the rental of designer clothing and furniture could further boost the market opportunity for shared commodities. Already, online platforms like YCloset are embracing this direction, providing a clothing rental service for consumers who pay a monthly subscription fee. YCloset has attracted high profile investors like Alibaba and brand partners like H&M, and as of 2019, had 15 million registered subscribers (Ringstrom, 2019). The new economic model requires businesses to transition from product providers to service providers, which can generate promising economic benefits. For example, the global maintenance and repair market was valued at \$1.3 trillion in 2019 (BusinessWire, 2019).

(ii) The opportunities of reuse models. Globally, an estimated \$460 billion worth of underutilized apparel is thrown away annually. If a garment is worn on average twice as long, the textile industry would potentially emit 44% less greenhouse gas (Lisca et al., 2021). Additionally, the second-hand clothing market is expected to grow five times in the next five years to US \$64 billion (ThreadUp, 2020). Domestically, reuse models could not only reduce negative environmental effects within China, but also generate business opportunities. In China, only 10-15% of the approximately 26 million tons of textiles discarded every year is collected and reused, suggesting ample opportunity for more reuse opportunities (Spuijbroek, 2019). Additionally, second-hand market for luxury products has huge potential in China. The demand has been rising steadily since 1990 and by 2017 the total sale accounted for 8 billion Yuan, with a foreseeable increasing at a rate of 20%. In the same year, the total number of second-hand luxury product stores was roughly 2500, of which 400 stores were specialized in newly used second-hand products. The demand for second-hand luxury products has become a viable option for the growing Chinese middle class (Cui et al., 2019).

Reuse models have also gained significant momentum in the world of packaging where a third of packaging ends up in landfill (Ellen MacArthur Foundation, World Economic Forum, and McKinsey & Company, 2016). This growing interest stems from the increasing recognition that reuse models offer not only a new range of solutions to plastic pollution, but also the potential to unlock significant business benefits. For example, Unilever has committed to reduce virgin plastic packaging by 50% by 2025, with one third coming from an absolute plastic reduction, and packaging producer Amcor's sales of reusable and refillable PET containers in markets where refill programs exist have doubled in the last two years (Ellen MacArthur Foundation, 2020). The Chilean startup *Algramo* aims to eliminate plastic packaging through its smart vending machines that dispense products like household cleaning products into refillable packaging (Closed Loop Partners, 2020). And such innovations are accompanied with high economic potential as well. In fact, converting 20 percent of the world's plastic packaging to reusable alternatives could translate into a US\$10 billion business opportunity (Ellen MacArthur Foundation, 2019).

(iii) New recycling business model empowered by technology. China has seen a growing number of tech companies participating in recycling business. New technologies such as the internet of things and big data have been applied to transform the household recycling business. They can improve the classification and sorting of domestic wastes, dramatically increase the household recycling rates, and create different forms of incentives including gifts, credit, vouchers to reward households based on their preferences. The involvement of high-tech companies will change people's attitude toward recycling industries and create more decent jobs, especially to well-educated younger generations.

However, national-wide large-scale recycling systems in China is still in its infancy but evolving rapidly. For instance, China launched a pilot program to create "waste-free cities" in 2019 and by end of 2020, the program expected to build 100 new large-scale recycling bases to tackle solid waste (Reuters, 2019). New technologies could have an important role in scaling up the small-scale recycling models in China, by tackling particularly the final consumers. For instance, deposit-return recycling model has already existed for decades in many cities. It was implemented by bottling companies to effectively collect empty glass bottles (for beer and coca cola, for example) from end consumers via local community stores. These bottles can then be cleaned the reused by the same bottling companies, which is an important cost-saving strategy. The principle is similar to the Deposit Return Schemes (DRS) in the western world. Through it, consumers are asked to pay a fee for the price for single use metal / glass or plastic containers in which the product

they buy is delivered. Being bottles for the selling of drinks the most common example. Upon return of the bottle, consumers receive their deposit back (Snowdon, 2019). China could adopt the DRS to expand its existing deposit-return recycling model at the national scale and use new technologies to better classify and sort waste to improve recycling rates.

3.2. Five enablers of circular economy in China's value chains

Box 9. Key takeaways – Enablers of circular economy in China's value chains

A combination of higher product standards, green finance, advanced technology, strengthened regulation and new business models are key to promote circular economy in China. The systemic change needed calls for a holistic approach that is best ensured through a coordinated green value chain mechanism.

- Establishing design and product standards and certification systems based on circular economy principles can both support a national strategy for better waste management encourage transparency in cross-border trade. Setting regulations and product certifications to support secondary markets for recyclable raw materials, goods and waste indirectly supports consumer demand for higher quality, recycled products.
- Innovative green finance solutions are needed to break down barriers to accessing finance for circular economy business models, particularly that sought by small and medium sized enterprises.
- Advanced technologies like robotics, blockchain, and the Internet of Things can help to accelerate the transition to a circular economy through disruptive change, from improving transparency to enhancing the recyclability or reuse of products.
- Appropriate regulation is needed to create incentives for circular economy throughout the value chain. Examples include Extended Producer Responsibility (EPR) and Deposit Return Schemes (DRS), two schemes that have proven to be of great use to develop reuse and recycling by both producers and consumers. Strengthened institutional capacity and law enforcement will be needed to ensure their success.
- New circular business models are needed to ensure businesses thrive in a circular economy and to nudge consumers to make optimized circular decisions.

The opportunities in the circular economy are vast, and as discussed, there are myriad ways for China to apply the latest practices and trends. In this pursuit, China can leverage five cross-cutting enablers to enhance and facilitate its circular economy policies, which are the focus of this section. The cross cutting and intersecting nature of these enablers calls for a coordinated approach which could be included within the remit of the Global Green Value Chains Institute.

3.2.1 Circular economy design and product standards and certification systems

China is well-positioned to develop align its domestic circular economy polices to the highest standards, setting the pace on the international stage. China could establish itself as a recognized force in design and innovation, and counter current perceptions of Chinese manufacturing as low cost and low quality. Establishing clearer product standards and certification systems that can be implemented through China's green value chain mechanism can both support a national strategy for better waste management while also encouraging transparency in cross-border trade. Through regulation and product certification systems, China can directly support the growth of secondary markets for recyclable raw materials, goods and waste and indirectly boost consumer demand for higher quality, recycled products.

China's laws and guidelines adopted on product standards to help reduce plastic provide an existing example of such regulation and standard setting in China. The General Administration of Quality Supervision, Inspection and Quarantine, a ministerial-level department under the State Council, has elaborated two product standards for manufacturers: the 2013 Product Standard on Plastics, particularly polystyrene compounds, and the 2014 Product Standard on Paper and Plastics, including laminated films and pouches for food packaging. These standards, however, are not legally binding (Garcia, et al. 2019).

Other examples of how regulations and standards could foster the mainstreaming of circular economy include: requiring application of extended warranty periods to all electronic appliances; and standardized information on reparability and reuse of products and related incentives to encourage their repair and reuse.

There is also a need to harmonize and integrate certification systems that are tailored to different stages of the value chain. For example, standards for certification of soft commodity production, can be better integrated with the certification of recycled content within products, tools for full product life-cycle analysis, environmental product disclosures, and standards relating to product design and use, such as building certification systems. Such integration could reduce confusion for consumers and procurement offices and help them make sense of the plethora of claims and certification systems that could apply to any given product or service. Chinese agencies should maintain an inventory of established international standards and relevant certification systems to identify opportunities for better integration, adoption or recognition of these within China's policies and guidance to companies. Close multilateral collaboration among producer and consumer countries is needed to optimize the alignment of different product standards for cross-border trade.

3.2.2 Tapping into options within green finance to support circular business models

Companies, and in particular SMEs following long-term circular business models often generate lower short-term return on investment and therefore struggle to secure proper financing.

China's government, central bank and financial regulators can help to ease this process. The Chinese government can directly invest in circular economy activities and innovation, set direction and level the playing field through, for example, pricing externalities. Its central bank and financial regulators can integrate circular concepts in risk assessments and modelling, scale dedicated circularity measurement tools, and integrate circularity metrics in leading existing frameworks (Ellen MacArthur Foundation, 2020).

China can tap into its existing momentum on green finance. Already, China issues more green bonds than any other country except the United States (Fleming, 2020) and domestically, China dedicated an estimated CNY 17 trillion (US \$2.5 trillion) to environmental protection projects during the 13th Five-year plan.

The Chinese government can design policies to ensure that SMEs have better access to financial services – perhaps by providing risk mitigation financing schemes as a guarantor on loans. They may be able to help the established waste management and recycling industry, for example, which tend to be smaller in size, through various financial vehicles to raise funding – particularly since the recycling industry is generally less attractive to investors (Cochu Bengtsson, 2019). South Korea, for example, provides financial assistance to waste management companies. This support is critical in China's ambitions to become an ecologically sustainable nation. [The EU Green Finance Taxonomy](#), provides a useful list of environmentally sustainable

economic activities, including circular economy, that could inform the setting of priorities for green finance to mainstream the circular economy in China.

3.2.3 Utilizing the advanced technologies of the 21st century

Already, China is among the world's leaders in disruptive technology, with city hubs like Beijing and Shanghai leading in areas like quantum computing, artificial intelligence, and big data (KPMG, 2020). By leveraging its technological prowess, China can introduce new ideas and practices to enhance its circular economy policies and establish itself as a global vanguard of circularity.

Advanced information technologies like robotics, blockchain, digital markings and Internet of Things can help to accelerate the transition to a circular economy through disruptive change. From improving the transparency of materials to enhancing the recyclability or reuse of products, such innovations enable the ease and adoption of circular practices and can help shift society towards a more circular world.

Such approaches will also encourage universal global trading standards by making it easier to track the origins of a material and generally promote greater materials traceability through embedded product information.

Companies worldwide are also putting advanced materials technologies into practice. For example, Miniwiz has developed a proprietary plastic which combines municipal plastic waste with rice husks through a manufacturing process that emits 40 percent less CO₂ as compared to conventional processes (Gyebnár et al., 2018), while Haier Models Co utilizes 3D printing to rapidly manufacture prototypes of home appliances, allowing for an iterative design process to improve product quality.

3.2.4 Strengthening regulations and institutions within China and beyond

China needs to promote circular economy principles through strengthened regulations and institutional capacity. Deposit Return Schemes, Extended Producer Responsibility and bans on unwanted products (e.g., plastic shopping bags) are amongst the regulatory tools that could be applied more extensively.

Since 2015, China has established a legal framework and regulations to guide the implementation of EPR throughout the entire product life cycle, from product design, to retail, consumption, reuse, recycle, and waste management. During the 14th FYP period, the government could upscale the key EPR pilots of the 13th FYP for e-products, auto products, paper-based beverage package and lead-acid batteries. However, new institutions are needed to promote these schemes at scale to generate the expected impacts.

EPR, DPS and extended warranty periods are included in relevant Chinese laws, regulations and policy documents, including the Circular Economy Promotion Law of the People's Republic of China in 2008, the Overall Plan of Ecological Civilization System Reform in 2015, and the Plan of Extended Producer Responsibility System in 2016. However, their effective implementation requires the establishment of infrastructure such as compatible recycling systems, as well as extended policy support in other relevant areas, such as facilitating the information sharing and collaboration among production enterprises, recycling enterprises and e-commerce platforms.

EPR pilot projects have already been developed and implemented for electrical and electronic products during the 13th FYP period. The 14th FYP requires that EPR pilot projects to be also developed for automobile products. However, it is important that the DRS and EPR systems are quickly expanded to other sectors,

especially for packaging materials usage in the e-commerce delivery service for both commodities and food. Chinese giant e-commerce actors, including Alibaba, Jingdong and Suning have used various incentives (for example, price discounts and shopping coupons) to encourage consumers to choose green packaging in online orders, such as tape-free boxes and biodegradable packaging materials. However, more incentives are needed to encourage larger number of participations.

As an example, China's paper industry could be encouraged to do more recycling by means of EPR laws. For example, the responsibility of e-commerce businesses could be extended to cover other packaging materials as well, including paper and plastic packaging, accounting for roughly 40% of the used packaging (Duan et al., 2019). More recently, in 2017, Chinese government made legislative push on EPR and eco-design, signaling if right products are put on market with repairability and recovery in mind, we will not only reduce the material use and impacts, but also generate more value without selling more stuff.

Furthermore, EPR schemes can be extended cross borders to nudge producers towards producing high quality products that allow for an extended product use and reducing environmental impacts beyond the country jurisdictions. The implementation of cross-border EPR schemes need to be regulated by stringent domestic policies under the international conventions, such as the Basel convention, which restricts the exports of plastic wastes that are hazardous or hard to recycle. The EU has internalized the list of restricted plastic wastes in its waste shipment regulation (EU 2020/2174), but law enforcement needs to be strengthened to ensure the effectiveness of this regulation.

Deposit return schemes can nudge consumers behavior to support recycling of packaging. To date, about 40 countries globally have set DRS (UK Parliament, 2017). Well-designed and well-implemented DRS can increase the collection rate of beverage containers and improve material capture at high levels of purity and quality – Germany, Norway and the Netherlands, for example, each operate a DRS and report a 95 percent or higher collection or recycling rate of plastic beverage bottles (UK Department for Environment, Food & Rural Affairs 2018). There are potential emissions benefits here as well: Scotland estimates that its 2022 plan for a country-wide DRS on used bottles and cans will reduce greenhouse gas emissions by 4 million tons over a 25-year period (Zero Waste Scotland, n.d.). DRS could be implemented in China to increase its ration of domestic recycling, which is currently behind the one of other western countries.

3.2.5 Developing new circular business models to support the transition to green consumption

A transformative introduction of circular economy calls for new business models in which business can thrive without being dependent on unchecked consumption.

Shifting from providing products to providing services is the most common approach often facilitated by advanced information technology. The company retains ownership of the asset and derives profit from selling a service to the customer thus ensuring maximum utilization and accordingly, reduced environmental impact. As shown in section 4.1.5, policy incentives and new business ideas are needed to avoid unintended rebound consequences of the sharing economy.

An example is the Dutch lighting company Philips. The company introduced 'Circular Lighting' or 'pay-per-lux' back in 2009, which allows a client to make an individual service contract with Philips for a specific level of brightness for a facility measured in lux. Rather than selling light bulbs, Philips provides a full installation, power and maintenance service and has an incentive to install the longest lasting, highest efficiency equipment, rather than the highest number of bulbs (OECD, 2019). Integrated into the value

proposition of a physical product such service components can build up high-quality branding and consumer loyalty to the brand, (Bocken et al., 2016).

Companies in the apparel and furniture sector have implemented models for buying back, repairing or refurbishing and then reselling their products, thus securing the secondhand value of their brand. This maximizes longevity and supports an imperative to design for longer life and repairability.

Relevant government campaigns, such as President Xi's "Clean Plate" campaign against food waste, that aim to accelerate the shift of consumers' attitude and behavior toward a "reduce and reuse" consumption model, need to be continued. Opportunities should be identified to promote and mainstream green procurement by government agencies, schools, state-owned and private companies, to trigger circular economy approaches in major sectors such as construction and catering.

4. Policy Recommendations

The impact of COVID-19 and climate change on the economy has increased global awareness of the urgent need to transition to sustainable and circular production and consumption patterns. To help realize the new development patterns envisaged in the 14th Five-Year Plan, the “dual circulation” strategy, and the goals of peaking carbon emissions by 2030 and reaching carbon neutrality by 2060, China should seize the historical opportunity to speed up its greening of global value chains by taking actions to:

- Adopt regulations requiring due diligence in soft commodity value chains, develop green finance measures, leverage technological advancement related to traceability, and utilize trade policies to support green value chains and promote the overall green transformation of economy and society.
- Promote circular economy, as an integral part of green value chains, through a combination of higher product standards, green finance, advanced technology, strengthened regulation and new business models.
- Accelerate the establishment of a green value chain promotion mechanism incorporating circular economy principles, and a technical support system to facilitate these priority actions.

Table 3. Summary of recommendations

Six priorities to promote green value chains in China and beyond	
Communication	Communicate China’s intentions to develop a strategic framework for greening value chains in collaboration with international partners
Regulation	Develop a regulatory framework for due diligence and traceability measures for soft commodities
Technology	Develop technologies to support due diligence and traceability
Finance	Create new financial instruments that favor green value chains
Trade	Include green value chain measures in trade agreements
Circular Economy	Mainstream circular economy principles to support green consumption and sustainable sourcing
Accelerate the Development of China's Green Value Chain Promotion Mechanism	
Institution	Constitute China’s Green Value Chain Promotion Mechanism
Planning	Develop plans and priorities for the Green Value Institute
Research and Policy dialogue	Foster research and policy dialogue to support the greening of the entire value chain

4.1. Pursue six priorities in the new development phase for China on Green Value Chains

4.1.1 Communicate China’s intentions to develop a strategic framework for greening value chains in collaboration with international partners

China should formally announce its intention to green value chains in relevant international fora to provide the impetus for leaders, government agencies, companies, financial institutions, civil society organizations and partners, in China and other countries, to work together to create and implement a robust global green value chain strategy in China and beyond. China could pursue the following near-term windows of

opportunity to engage with international partners and communicate its ambition and commitment on greening value chains.

Specifically, China can –

- Announce an ambitious commitment to the greening of global value chains at the CBD COP 15, while encouraging other countries to contribute.
- Promote the inclusion of global green value chains as one of the topics in the G20 Summit for global leaders to discuss, striving to reach consensus and take common actions.
- Leverage the UNFCCC COP 26, to introduce China’s commitments and positions on fostering green global value chains and promoting the “dual circulation” strategy, and the goals of peaking carbon emissions by 2030 and reaching carbon neutrality by 2060, through green value chains.
- Convene green value chain discussions and sessions at the CBD COP 15 Ecological Civilization Forum and Business and Biodiversity Forum, to publicize the outcomes of this study, encourage participation and communication among key stakeholders, and facilitate the establishment of a strategic framework for the greening of soft commodity value chains in China and beyond.

4.1.2 Develop a regulatory framework for due diligence and traceability measures for soft commodities

Due diligence and traceability systems enable importers, financiers, the government, and consumers to distinguish those tons or shipments of soft commodities that meet legal and sustainability criteria from those that do not. By adopting regulations to require due diligence and traceability measures for ensuring legality and sustainability in soft commodity sourcing, China would be keeping up with major markets and strengthening the long-term security and resilience of its value chains.

The regulatory framework would require companies and financial institutions to exercise due diligence to ensure relevant soft commodities within their value chains or investment portfolios are produced legally in their country of origin. It would also encourage companies and financial institutions to assess the sustainability of commodities against applicable standards. The obligation to conduct due diligence would apply to all companies with such commodities in their value chains and all institutions that provide finance for the production and trade of such commodities.

Such regulations would be consistent with several proposed actions in the “Green Development Guidelines for Overseas investment and Cooperation” (MOFCOM and MEE, 2021). The Guidelines call for measures to:

- Promote green production and operation (and specifically due diligence to identify potential environmental risks, build green supply chains, and adopt the green procurement practices);
- Facilitate green business transition (and specifically strengthen the green compliance system and set a standard for business practices overseas to fill in the regulatory gaps);
- Prevent environmental risks (and specifically to encourage companies to take rational and necessary measures to reduce or mitigate adverse ecological impacts from investment and cooperation activities in accordance with the laws and regulations of the host country, protect and restore the affected ecosystems in accordance with the law or international practice in case of adverse biodiversity impacts, encourage companies to adopt international or Chinese standards in investing activities where local laws and regulations are non-existent or too lenient);
- Optimize green regulatory services (and specifically strengthen the monitoring and analysis of green business development and enhance IT-based regulation).

The development of this regulatory framework should be coordinated with the work of the BRI Environment Big Data Platform and the BRI International Green Development Coalition to ensure coherence with the BRI Green Value Chain Development Index. The framework should also help inform future policy guidelines from relevant government agencies related to green procurement, supply chains, trade, and finance.

4.1.3 Develop technologies to support due diligence and traceability

China can harness the revolution in monitoring and tracking technologies so due diligence and traceability become more feasible, practical, and affordable. This will make it easier for companies (especially small/medium-size enterprises) to verify their compliance with green criteria. By adopting these systems, Chinese companies can be ready to comply with new regulations by countries that import or export commodities. For circular economy purposes, block chain and digital markings can improve the transparency of materials, enhance the recyclability or reuse of products, tighten the connection between upstream producer and downstream consumer, and enable the ease and adoption of circular practices.

China has already issued detailed guidance on the role of governments and companies in establishing traceability systems for certain products. Drawing on this guidance and experience gained in sectors such as meat and vegetables, alcoholic products and drugs and herbal medicines, China can strengthen traceability systems for other soft commodities and products. In doing so, China should engage enterprises, especially small and medium sized enterprises, to ensure that due diligence and traceability systems and technologies fit well with business processes and are cost-effective when implemented.

4.1.4 Create new financial instruments that favor green value chains

China should leverage the power of financial Institutions to promote the uptake of green economy practices through innovative financing instruments. In turn, such instruments would help banks to manage risks associated with unsustainable practices (e.g., compliance, social and market risks to clients, default and reputational risks to banks). This could include innovative trade finance to producers, manufacturers, and traders that meet green performance standards. Such finance could offer low interest rates and/or fast-tracked payment of invoices as incentives for borrowers to achieve sustainability, traceability and circular economy targets. Additionally, innovative financial instruments such as green bonds and government guaranteed loans can be used to promote circular economy practices and break down barriers to accessing finance for small and medium sized enterprises that are operating under circular economy business models.

China should explore how best to apply or extend its Guidelines for Establishing the Green Financial System to create new financial incentives for the greening of value chains and uptake of related circular economy concepts. Specifically, the China Banking and Insurance Regulatory Commission (CBIRC), in collaboration with leading banks, should pilot new financial instruments and develop specific guidelines on how to green value chains in the Chinese context. This could include:

- Revising the *Green Credits Guidelines* and *Green Credit Statistical System*
- Extending the scope of green credits to include the financing of soft commodities that meet relevant sustainability and traceability requirements, and financing linked to circular economy practices
- Updating the *Guidance on Promoting High-quality Development of the Banking and Insurance*

Industry and plans to strengthen data disclosure requirements.

Such green value chain finance measures can build on the work of the BRI International Green Development Coalition and the work underway on how a “traffic light system” could evaluate the environmental performance of BRI investments. Such a system could support the greening of value chains if it applied to projects involving (a) the production and processing of soft commodities or (b) infrastructure and other projects that could indirectly encourage the expansion of soft commodity production. The system could include safeguards to limit the negative environmental and social impacts of soft commodity production while enabling the uptake of sustainable forestry and farming practices.

China should continue to engage with the G20 Sustainable Finance Working Group and its efforts to promote wider adoption of environmental risk analysis practices and improve public availability and access to environmental data to enable financial institutions to better analyze and manage environmental risk exposures and allocate resources to financing green investment opportunities.

4.1.5 Include green value chain measures in trade agreements

China can incorporate measures to green soft commodity imports in bilateral and multilateral trade agreements. This could include China’s participation in work at the WTO on creating tariff benefits for green soft commodity trade, work to coordinate sustainability standards for soft commodity production and trade at the Asia-Pacific Economic Cooperation (APEC), the Regional Comprehensive Economic Partnership (RCEP), beginning with a few pilot efforts, and the Forest, Agriculture and Commodity Trade (FACT) Dialogue, under which countries have committed to work together to protect the world’s forests while also promoting sustainable trade.

The China International Development Cooperation Agency (CIDCA) could provide south-south development assistance to supplier countries to build capacities related to the supply of green commodities. Such assistance would include grants, interest-free loans, concessional loans, and technical assistance for practices and technologies that boost commodity yields on existing agricultural land (linked to avoided deforestation), improve traceability, and improve policy design. The purpose would be to support uptake of legal and sustainable production processes, development of verification and traceability systems, as well as measures to protect and restore forests and other ecosystems for biodiversity conservation and climate change mitigation and adaptation, while respecting the needs of farmers, local communities and indigenous peoples.

Such actions would align with the “Green Development Guidelines for Overseas investment and Cooperation” (MOFCOM and MEE, 2021), so far as they call for action to “optimize green regulatory services”. Specifically, the Guidelines call for actions to “strengthen strategic alignment and policy exchanges with countries involved and create an enabling environment for companies” and to “encourage overseas Chinese chamber of commerce or associations to study and develop guidelines for green investment and cooperation in host countries”.

As countries continue to build their interest in the circular economy, global trade policies and practices need to be designed with circularity in mind. In this way, trade agreements could simultaneously foster green consumption while encouraging transparency in cross-border trade. Ultimately, China and other countries will benefit from more secure and stable supply chains if trade and the circular economy are approached as an interlinked system.

4.1.6 Mainstream circular economy principles to support green consumption and sustainable sourcing

China should adopt a holistic, systemic approach to upscaling circular economy concepts as drivers of green consumption and sustainable sourcing within value chains. In doing so, China should leverage five key enablers of circular economy (described more fully in Section 4.2 of this study) –

- Circular economy design and product standards and certification systems
- Tapping into options within green finance to support circular business models
- Utilizing the advanced technologies of the 21st century
- Strengthening regulations and institutions within China and beyond
- Developing new circular business models to support the transition to green consumption

Due to the cross-cutting and intersecting nature of these enablers, the Green Value Chain Coordination Mechanism (described below in Section 4.2) should be mandated to explore how circular economy solutions can help make value chains greener, and to coordinate and support implementation of circular economy measures, including how domestic standards and approaches can articulate with international standards and agreements.

4.2. Accelerate the Development of China's Green Value Chain Promotion Mechanism

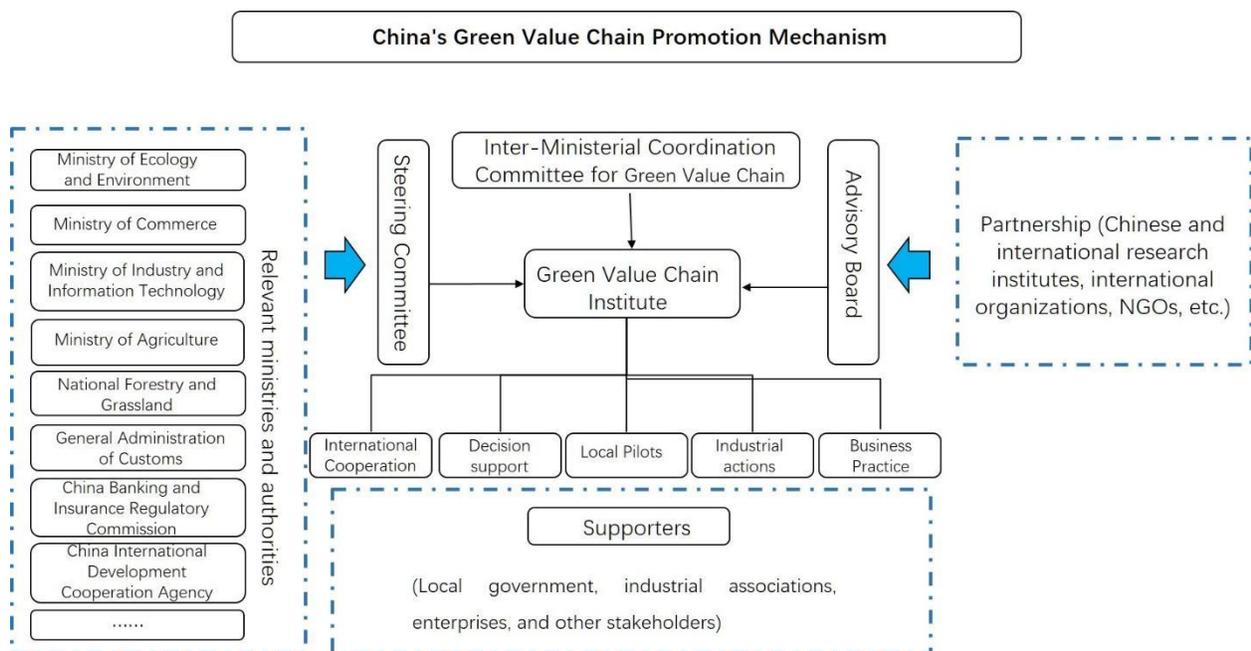
As recommended in the first-phase Special Policy Study on Global Green Value Chains (CCICED 2020), China should set up a mechanism to promote green value chains with the technical support of a "Global Green Value Chain Institute". The mechanism should drive China's green value chain strategies in support China's 14th Five Year Plan, ambitious carbon neutrality target and the "dual circulation" strategy. It would ensure coordination and technical support to greening value chains across multiple ministries and international bodies, including priority actions under Recommendation 4.1.

4.2.1 Constitute China's Green Value Chain Promotion Mechanism

China should fully constitute the Green Value Chain Promotion Mechanism based on the structure depicted in Figure 5. Subject to further deliberation, this would include setting up an inter-ministerial coordination committee, composed of relevant ministries and commissions (e.g., Ministry of Ecology and Environment, Ministry of Commerce, National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Agriculture and Rural Affairs, National Forestry and Grassland Administration, General Administration of Customs, China Banking and Insurance Regulatory Commission, China International Development Cooperation Agency, etc.) to review and approve China's green value chain strategy, policies, plans and roadmaps, and organize and coordinate amongst members to advance work tasks.

Each member ministry should appoint relevant departments/bureaus and responsible personnel as liaisons to form the Steering Committee to supervise the Green Value Institute and its implementation of tasks. Further, relevant industrial associations, research institutes, international organizations and NGOs will form the Advisory Board to provide intellectual, technical, financial, and project support for the Green Value Chain Institute.

Figure 5. China's Green Value Chain Coordination Mechanism



4.2.2 Develop plans and priorities for the Green Value Institute

The "Global Green Value Chain Institute" was set up in FECO of Ministry of Ecology and Environment in 2020, to serve as the core technical support body within China's Green Value Chain Promotion Mechanism. While its capacity needs to be strengthened, the Institute should expedite development of a framework for technical support for the promotion of green value chains, which can operate as a long-term cooperation mechanism with multiple stakeholder participation.

The institute should also support the development of a five-year plan and roadmap for China's green value chain development and begin fostering relevant research and policy dialogues.

The plan and roadmap should align with the focus of this report and prioritize actions related to the greening of soft commodity value chains, and circular economy measures to promote sustainable consumption and circular economy practices in a few selected sectors such as timber and food. The scope could be expanded to include actions related to hard commodities or other sectors in future years. Commodity- and sector- specific plans should be developed for what China and other major countries can do to green their global value chains, how to do it (including pilot applications), and who needs to do what. To this end, the Institute should establish a collaboration network and information exchange platform for stakeholders and reach a consensus on a national strategy that will have the greatest impact on the greening of value chains in China. The roadmap should clarify how the actions proposed relate to China's vision for ecological civilization, economic green recovery, and other major policy frameworks. The roadmap should encourage the participation of all relevant stakeholders, including those working on social and gender-related issues.

4.2.3 Foster research and policy dialogue to support the greening of the entire value chain

The Global Green Value Chain Institute will lead and coordinate scientific research and policy dialogue to enable development of new systems for soft commodity due diligence and traceability systems and selected circular economy practices. The priorities and sequencing of this research and dialogue should be outlined in the five-year roadmap.

For soft commodities, the research and policy dialogue should target specific commodities and sectors to ensure that relevant commodities are legally and sustainably produced in their country of origin. For example, initial work on soft commodity due diligence and traceability systems could focus on beef and soy from Latin America, timber from the Congo Basin, and palm oil from Indonesia. Research should also focus on the benefits, cost, and limitations of different technologies and tools that could support the development of due diligence and traceability systems in China. The design of measures to ensure the legality and sustainability of commodity production should include capacity building to ensure effective participation of small and medium-sized enterprises along the entire value chain, as well as relevant producer country stakeholders – from government agencies to smallholder farmers. Such capacity building should recognize the role of large and progressive corporations in engaging their suppliers and in convening pre-competitive sector-wide platforms or jurisdictional approaches to enable uptake of aligned and consistent systems. The relevant policy paths and systems will be analyzed to determine which government departments and industries need to be involved in the formulation and implementation of due diligence and traceability system plans for those commodities.

The domestic circular economy research and policy dialogue should draw on the latest international circular economy policy and practice, learn from existing regulations and incentive policies that were successfully implemented to support secondary markets for recyclable raw materials, commodities, and waste, and guide and foster consumer demand for higher-quality, recyclable products. Greener consumption can drive market demand for greener products, which is an important incentive to foster major changes in production practices to meet this demand. After progress is made on soft commodity sourcing and production, and the circular economy priorities in the initial roadmap, the Institute could expand the focus of its research and policy dialogue to additional commodities or circularity objectives.

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