

How Can Global Value Chains Contribute to Greening the Global Economy?

Roberta Rabellotti University of Pavia

with

E. Gentile, R. Lema & D. Ribaudo

UFRJ IE - Rio de Janeiro 17/07/2023

Environmental consequences of GVCs

- Scale effect: GVCs increase global economic activity, leading to rising emissions, increased transport volumes, travels, and waste production, as well as overexploitation of concentrated scarce resources.
- Composition effect related with the distribution of tasks across the world, which could be bad if polluting companies move to countries where environmental regulations are lax as opposed to locating economic activity where it is most efficient.
- *Technique effect*: knowledge spreading within GVCs can enable and push for environmental innovations and the development and application of environmentally friendly products and processes at different supplier levels.

Objective

- Focus on the technique effect by developing a conceptual framework to address questions related to greening in GVCs: *why, what, so what.*
- Focus on traditional manufacturing industries (e.g., food production, garment and textiles, leather and shoe, and furniture) in latecomer countries.
- Focus on renewable energy GVCs in another paper (*Lema, R., E. Gentile, and R. Rabellotti. Green GVCs: are there upgrading opportunities for developing countries?*).

The conceptual framework



- WHY: Driving factors of GVC greening:
- WHAT: Environmental innovations generating GVC greening
 - WHO: Actors involved in the innovation process
 - HOW: Enabling mechanisms adopted by the different actors to develop and implement the environmental innovations

• **SO, WHAT:** Biophysical outcomes of GVC greening

The table summarizes the different elements of the framework and identifies the questions driving the literature survey to find evidence about GVC greening, with a focus on traditional manufacturing industries (e.g., food production, garment and textiles, leather and shoe, and furniture) in latecomer countries.

	Why?	What?	Who?	How?	So what?
Key question	What are the driving factors of GVCs greening?	What type of environmental innovation is involved in the GVCs greening?	Who are the actors involved in environmental innovation?	How is environmental innovation implemented in the value chain?	What are the biophysical outcomes?
Description	The root causes of GVC greening	The main forms of environmental innovation in GVCs	The key actors in the greening of GVCs	The enablers of GVC-greening	The outcomes of GVC-greening
Main categories	Institutional drivers At national level Introduction of sustainability standards Introduction of carbon taxes Introduction or changes in national environmental legislations At global level Environmental provisions in trade agreements International environmental agreements Market drivers Changes to green demand preferences amongst consumers or professional users in existing markets Shift of market demand to green lead markets Technology drivers New green technology in manufacturing Digital technologies to minimize waste, energy use, enforce traceability 	 Environmental process innovation Substitution of energy-sources, energy intensive materials, scarce natural resources, toxic inputs Reduction of waste from the production process Reduction of energy consumption Optimization of the material flow Environmental product innovation New designs substituting environmentally harmful components Designing of recycle products Designing for durability Substitution of complete environmentally harmful product Recycling Re-use of waste Environmental organizational innovation Lean production Green Supply Chain Management 	 Chain internal actors Lead firms: buyers and producers Suppliers (different tiers) Chain external actors National/Local governments NGOs, Civil Society Organizations 	 Lead firm enabled Standard-driven Mentorship driven Internally enabled, i. e., autonomous building of internal knowledge Collectively enabled: i.e., business associations, consortia State-enabled, i.e. local and national governments 	 Climate change mitigation Mitigation of biodiversity loss Sustainable use of territorial and marine ecosystems Diffusion of affordable, reliable, and sustainable energies Diffusion of sustainable consumption and production patterns
Additional questions	 Can the drivers be traced to specific structural changes associated with the green transformation? Are the drivers national or global? 	 Did the innovations involve several types of innovation at once, cross-cutting between product and process? In which stages of the GVC is the green innovation taking place? 	 Is there mainly one driving actor or innovation does take place between different actors? How do internal and external actors interact with each other? 	 What are the key enabling mechanisms? What was the process before and after the environmental innovation? What had to be learnt (or what were the hurdles)? Is learning taking place at the collective or individual level? In which areas capabilities have been built? Which incentives should be set across the chain to foster the diffusions of environmental innovations? 	 Did the innovation results in greener GVCs overall? Are reputational outcomes overcoming biophysical outcomes? Are there any scaling-up effects? Are there any trade-offs? Positive outcomes together with negative outcomes Who are the beneficiaries of the greening? Who are the losers? Does the greening effect impact differently on different actors in the GVC?

Table 1 - The different elements of GVC greening

Why? Drivers of GVC Greening

Institutional drivers

- National governments introduce environmental legislation that induces environmental innovation in the home economy (e.g., carbon taxes)
- Carbon accounting increasingly applies not only to emissions of the reporting company, but also to indirect emissions in the forward and backward linkages of the firm ('Scope 3 emissions': indirect emissions that occur in the value chain of the reporting company, including both upstream and downstream emissions. e.g. More than 75% of total emissions)
- Institutional drivers may also arise in multilateral settings, including through private governance mechanisms
 MAERSK

Market drivers

SPENCER

- Changes to green demand preferences amongst consumers in existing markets:
 - Many lead global buyers introduce fair trade labels that include certification of compliance with environmental standards.
 MARKS& TESCO
- Shift of market demand to green markets, i.e., from locations with lax environmental regimes to markets with more stringent environmental protocols.
- Shift of final demand from one market to another with significantly higher environmental attention:
 - Demand for lithium shifting from ceramics and glass to lithium-ion batteries, inducing environmental innovations to reduce mining waste at the source of GVCs.

Technology drivers

- The diffusion of digital technologies is particularly relevant to greening GVCs: The twin transition.
 - Smart manufacturing practices use new technologies, such as RFID tags, which can improve logistics efficiency and thereby reduce global trade's overall carbon impact.
 - Data processing technologies—big data, blockchain, cloud computing, and AI—can help to minimize waste and energy use







TECHNOLOGY AND INNOVATION

What? Environmental innovations

- Environmental innovation in GVCs is defined as a radical or incremental change in processes, products and organizational models that results in the reduction of the chain's ecological footprint – such as its impact on greenhouse gas emissions, biodiversity losses, and natural resources overexploitation.
 - GVC greening happens when there are net environmental gains from the introduction of environmental innovations.

Environmental process innovation

- The reorganization of the production process and/or the use of superior technology to increase eco-efficiency along the different stages of the value chain:
 - Examples: reduction or substitution of energy sources and scarce natural resources, reduction of waste, elimination of toxic inputs, optimization of material flow.



Environmental product innovation

• Development of environmentally friendly products, i.e., designed for durability, using recycled inputs, reducing packaging, and re-using waste.





 Process and product environmental innovations often take place together, given that a change in the production process is often needed to modify a product.

Environmental organizational innovation

 Organizational changes reduce the environmental impact of companies, i.e., the adoption of "lean manufacturing" (e.g., maximizing productivity while simultaneously minimizing waste within a manufacturing operation)



Who? Actors involved in environmental innovation

Actors internal to the GVC: lead firms & suppliers

- In 'buyer-driven' chains, large retailers and branded merchandisers govern the supply chains.
- In 'producer-driven' chains, large manufacturers play the central role in coordinating the activities of their upstream and downstream suppliers.
- Suppliers may also autonomously introduce environmental innovations, contributing to GVC greening without a specific request by the lead firms:
 - Proactive introduction of new technical standards in the industry.



Actors external to the GVC

- Policymakers, customers, NGOs, etc.
- Policymakers can go beyond introducing and enforcing environmental regulations and become direct actors in the GVC greening process.





GREENPEACE





How? The enabling mechanisms

Environmental innovations enabled by lead firms

- Lead firms are the main actors responsible for the introduction of environmental innovations in GVCs:
 - With a standard-driven approach, the lead firm introduces specific rules and codes of conduct, aimed at reducing the chain environmental impact, that suppliers must satisfy.
 - A mentoring-driven approach is when the lead firm directly transfers knowledge and sustains suppliers' greening process.

Environmental innovation enabled by suppliers

- Suppliers autonomously invest in innovative activities to obtain a competitive advantage:
 - Cost reductions, development of new eco products sold at a premium price, and the expansion of the product portfolio.
- Case studies:
 - Leather cluster of Arzignano, Italy.
 - Apparel chains of Pakistan.

Collectively enabled environmental innovations

• More commonly in clusters, innovation is a collective effort given that companies, often characterized by a common specialization, are used to collaborate on innovative activities.

Environmental innovations enabled by the State

• A key enabling role is played by national or sub-national public actors when they provide the basic infrastructure that contributes to GVC greening (e.g., water treatment plant and an industrial sewage system for the tannery firms in the Arzignano leather cluster in Italy and eco industrial park with access to renewable energy in Ethiopia) So what? The outcomes of GVC greening

Biophysical outcomes of GVC greening

- CO₂ emissions: in studies focusing on environmental innovation and potential emission reduction from lead-firm schemes.
- *Biodiversity*: in studies about the uptake by companies in deforestation linked GVCs for environmental monitoring and improvement and schemes to ensure sustainable wood harvesting.
- Sustainable land use: in studies about the introduction of certification and standard schemes to reduce or avoid soil degradation, e.g., in cocoa, palm oil, and beans and avocado.
- *Energy use*: in renewable energy initiatives.
- *Toxic materials*: in studies about the reduction or elimination of chemical hazards in products or services or water pollution.

Challenges to assessment of environmental issues

- Systematic measurement efforts are scarce, and the outcomes are highly complex to measure.
- Difficult to isolate, generalize, and attribute causal factors to single cases of firm-level or sector-level initiatives.
- Firms may exaggerate claims of reduced environmental harm or increased environmental benefit, while receiving a perceived image boost, i.e., 'greenwashing.'

Trade-offs

- Trade-offs between different green outcomes:
 - environmental impact of renewable energies, such as solar or wind, producing large amount of waste for the decommissioning of obsolete systems.
- Trade-offs between environmental and socio-economic outcomes:
 - lack of mechanisms to ensure that suppliers can obtain a return on investments
 - suppliers may end up in a 'squeeze' because they cannot capture a share of the gains from environmental upgrading that is proportional to their share of investment in upfront costs.
- The implementation of environmental upgrading practices may have the opposite effect:
 - Kenyan producers complying with environmental requirements from UK supermarkets which made them abandon multi-cropping systems for beans and avocados and grow crops in blocks resulting in worsening environmental outcomes.

A three-pronged strategy for GVC greening

(1) Create and augment the driving factors

National and sub-national level:

- Regulations and standards
- Taxation
- Consumption patterns
- R&D activities

Global level:

- Agreements to avoid environmental dumping
- Agreement to control transboundary toxic movements
- Agreements to lift tariff and non-tariff barriers to trade in environmental goods and services

(2) Leverage enabling mechanisms to support environmental innovations

Policies involving lead firms and domestic suppliers:

- Policies making lead firms responsible for the environmental impact of their suppliers
- Policies to support lead firms and suppliers that contribute to GVC greening
- Green procurement policies
- Green supplier database
- Incentives for cooperation on green innovative activities between lead firms and suppliers
- Policies to strengthen sustainable innovation ecosystems and knowledge infrastructure

Policies supporting collective initiatives:

- Activities aimed at driving the green agenda in business organizations
- R&D activities taking place in consortia

Policies aimed at building and strengthening infrastructure:

- Infrastructures and logistics such as access to renewable energies, waste management systems
- Investments in recycling industries
- In clusters and industrial parks invest in specific infrastructures which are needed to allow GVC greening in the dominating industry

(3) Monitor outcomes and address environmental inequalities

- Measures to address the unequal impact of greening within chains.
- Forms of regulation to orchestrate private sustainability initiatives to achieve fair and just environmental protection.
- Increase knowledge about biophysical outputs and develop monitoring system to measure complex outcomes.



robertarabellotti.it