Green Practices of Chinese Logistics Service Providers: Characteristics, Classification, and Evolution

Yongyi Shou

Zhejiang University, China

yshou@zju.edu.cn

Coauthors: **Chang Wu, Kee-hung Lai, Jinan Shao**

Logistics industry needs decarbonization
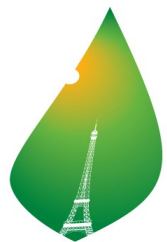
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

▶ Limit global warming to max. 2ºC in 2100

‣ requires 80% CO_2 reduction in 2050 related to 1990

‣ China set targets of peak GHG emissions in 2030

and net-zero GHG emissions in 2060

▶ Strive for max. 1.5ºC in 2100

‣ requires >95% CO_2 reduction in 2050 related to 1990

‣ transport sector should strive for >90% CO_2

reduction

We are only beginning to face the challenge

China CO$_2$ Emission

Metric tons

■ Total emission	■	Transportation, Storage, Post and Telecommunication Services
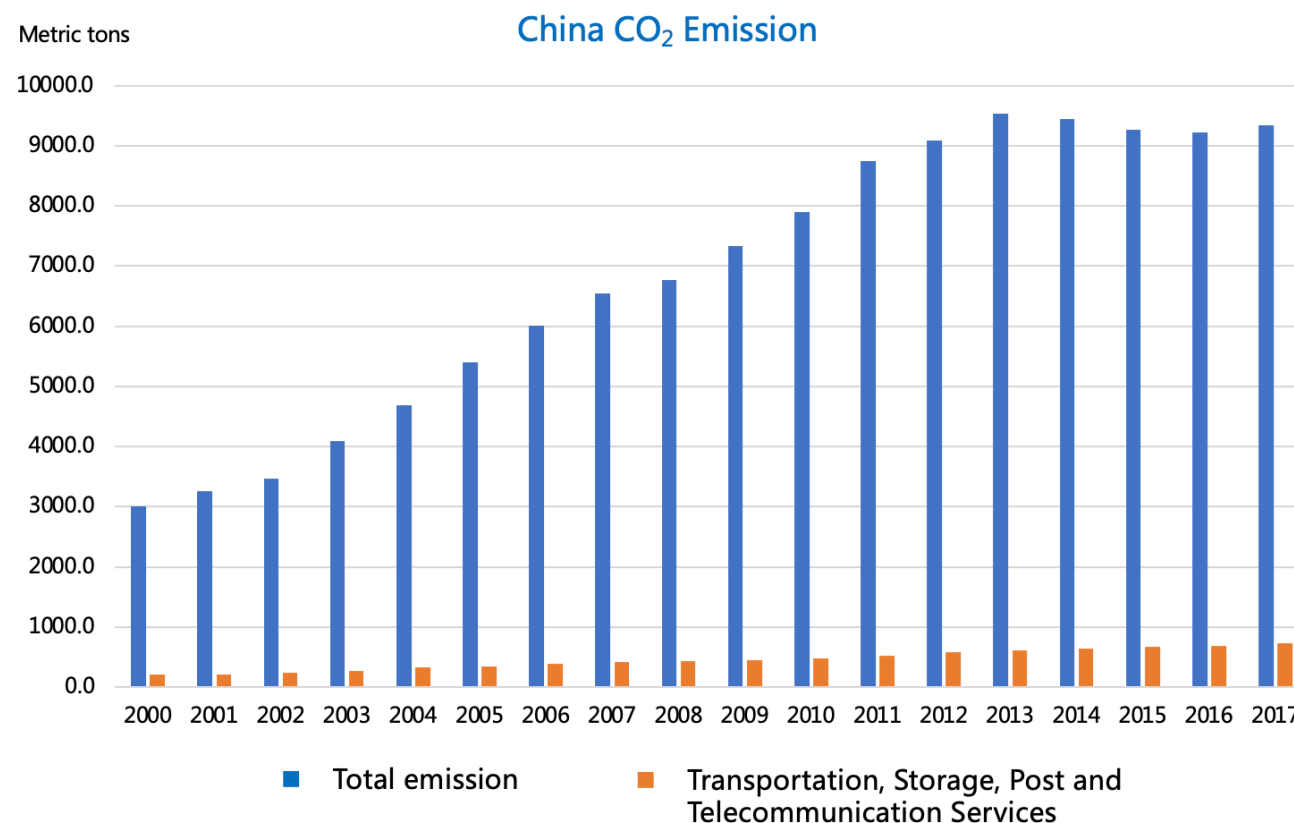
Source: CEAD, 2021

Logistics industry needs decarbonization

Policies on logistics industry in China

| 2015	2016	2017	2018-
Mainland: *Medium and Long-term Development Plan for logistics Standardization (2015-2020)* - Green logistics indicators - Green packaging	**Taiwan**: Make a commitment in *Low-carbon and green energy execution strategy*	**Mainland**: *The 13th Five-Year modern comprehensive transportation system development plan* - Green traffic equipment project	**Two main interventions to reduce freight emissions:**
		The 13th Five-Year Plan for Civil Aviation Energy Conservation and Emission Reduction - Learn advanced international experience - Improve the fuel efficiency of the fleet	(1) Reduce road and air freight, and increase water and railway freight;
Hong Kong: Signed the *Guangdong-Hong Kong Cleaner Production Cooperation Agreement*	**Hong Kong**: Signed the *Guangdong-Hong Kong Environmental Cooperation Agreement (2016-2020)*	*Green logistics index composition and accounting methods*	(2) Green transportation tools.
	Mainland-Hong Kong Air Pollution Prevention and Control Cooperation Agreement in the shipping industry	**Taiwan**: *Air pollution control strategy* - Control pollution from large diesel trucks - Promote pollution reduction in the port area	a. Clean/new energy trucks, ships, and planes b. Intelligent transportation system c. Infrastructure construction (e.g., charging and swapping network, hydrogen refueling station, shore power system)
	Pay close attention to ICAO's aviation carbon offset and emission reduction plan	**Hong Kong**: *Hong Kong Climate Action Blueprint 2030*	d. Elimination of old high-emission equipment

Logistics industry needs decarbonization

Three hard-to-abate sectors – Trucking, Shipping, Aviation

▶ Carbon intensity difference of trucking, shipping, and aviation logistics is huge.

▶ Green practices vary in carbon reduction levels.

- Logistics optimization practices are prevalent among LSPs, but with limited carbon reduction outcomes.

- New and clean energy in trucks, ships, and planes are desired, but with high uncertainty

Do different modes of transport logistics vary in their green practices?
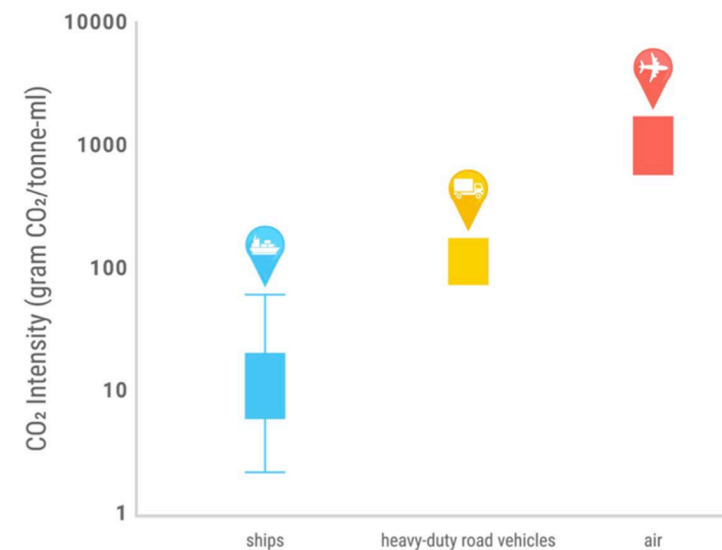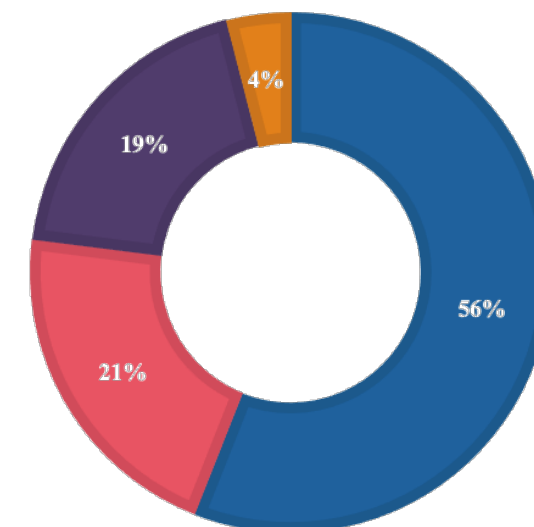
Research Motivation & Questions

Current studies have examined the influencing and performance effects of green practices adopted by LSPs

Lack of a systematic investigation of the characteristics, classification, and evolution of LSPs' green practices across different operation modes

- **RQ1:** What are green practices' characteristics, classification, and evolution within Chinese LSPs?

- **RQ2:** How do the foci of LSPs' green practices vary across maritime, road, and aviation operation modes?

- **RQ3:** What factors influence the priorities of green practices across different operation modes, and how and why?

Research design

Stage 1
(RQ 1& R2)
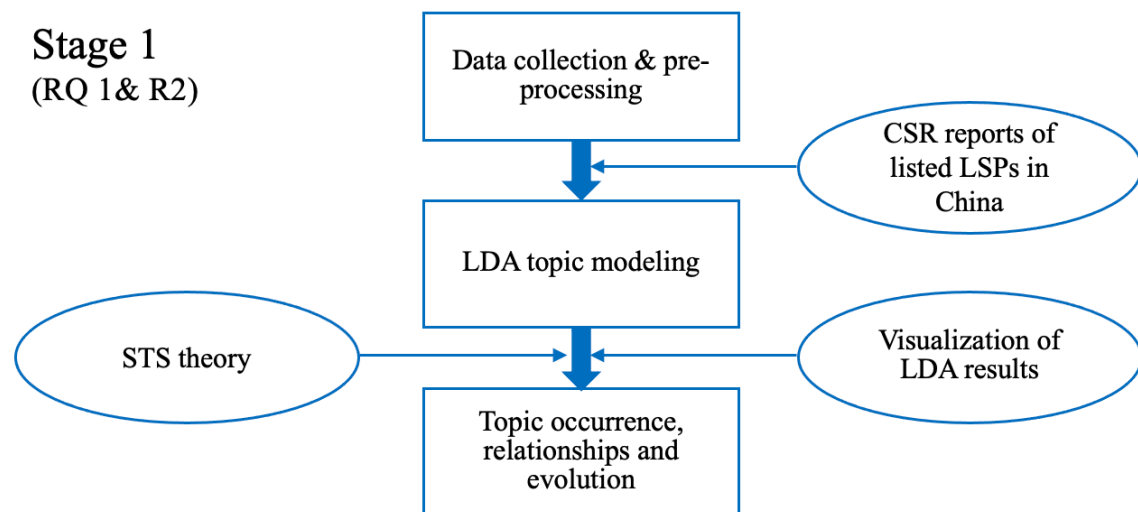
Stage 2
(RQ 3)

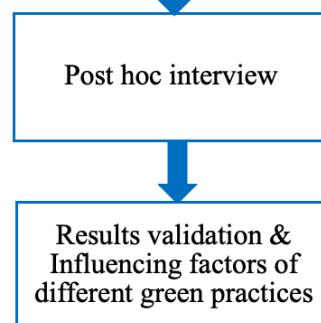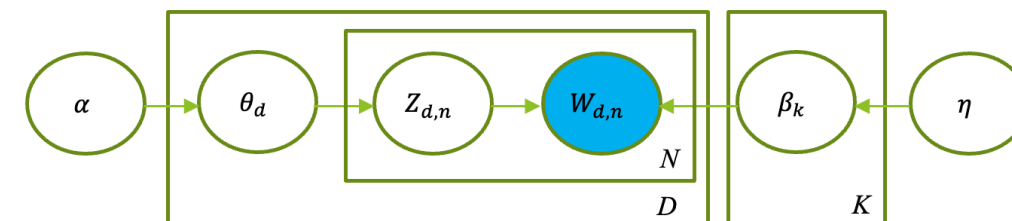| Report distribution by year	Frequency	%	Report distribution by regions	Frequency	%
2015	14	6.54	Mainland	96	44.86
2016	23	10.75	Hong Kong	50	23.36
2017	27	12.62	Taiwan	68	31.78
2018	33	15.42	Total	214	100
2019	37	17.29			
2020	40	18.69			
2021	40	18.69			
Total	214	100			

D plate denotes the total number of documents in the corpus;
N plate denotes the collection of words within documents;
$W_{d,n}$ is the only observable variable representing the nth word in document d;
α is the parameter of the Dirichlet before the topic distribution;
θ_d is the topic proportion for the dth document;
$Z_{d,n}$ is the topic assignment for the nth word in document d; K is the specified number of topics;
β_k is a distribution over the vocabulary;
η is the parameter of the Dirichlet before the word distribution.

- 3 listed courier express companies involving aviation and road transportation;
- 2 focusing on road transportation; and
- 1 liner-shipping company

LDA results – 18 topics

Topic popularity and correlation

Intertopic Distance Map (via multidimensional scaling)

Marginal topic distribution

- 2%
- 5%
- 10%
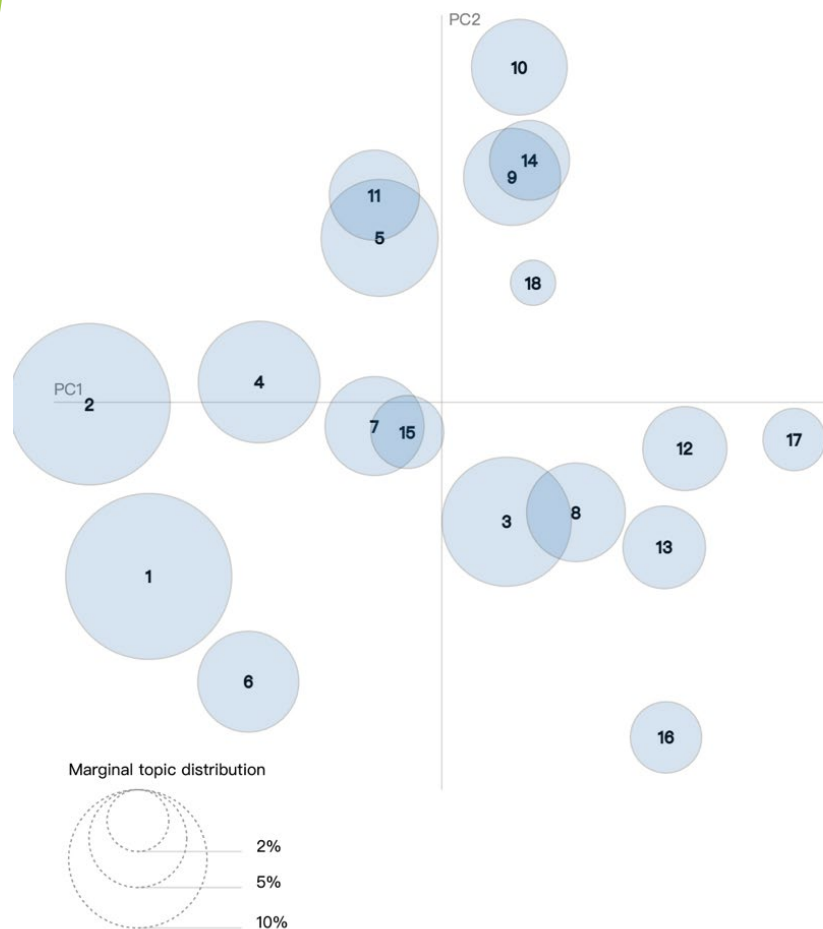
Topics identified

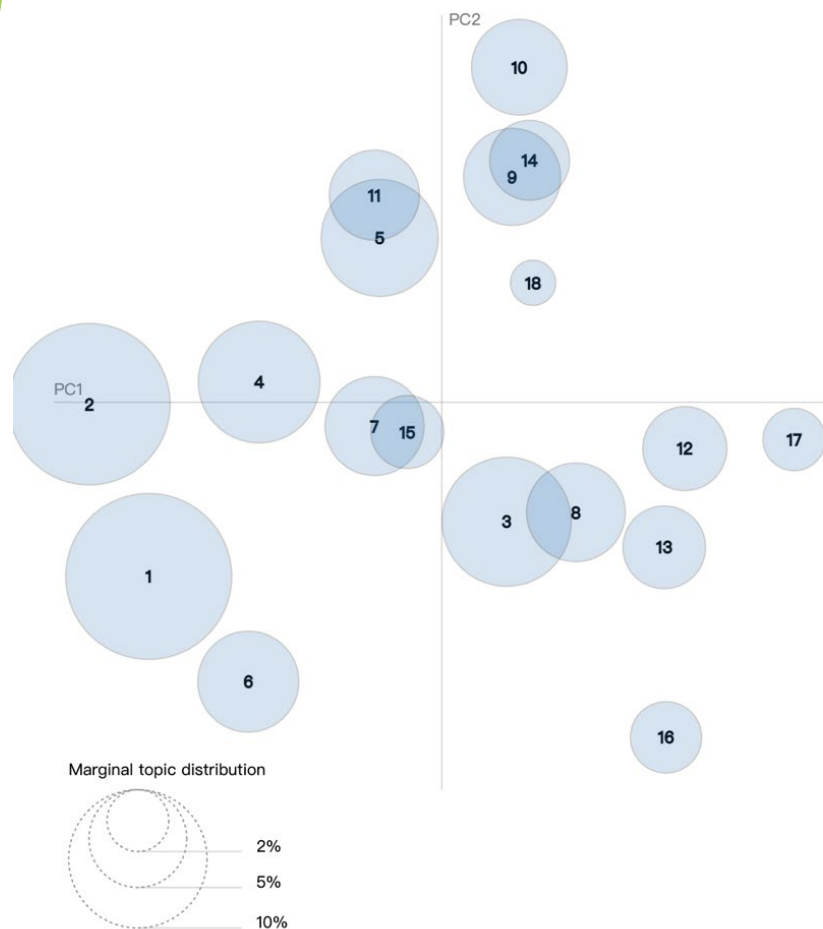| Topic		Mode	Practice type	High frequency keywords
1	**Energy Efficiency Improvements for Ships**	Maritime	Technology-driven	Ships, fleet, navigation, fuel, energy, efficiency, energy efficiency, ship type, ship speed, shipbuilding, power systems, fuel technology…
2	**Compliance with Regulations**	Maritime	Social-driven	Ships, garbage, ballast water, waste, conventions, regulations, legal rules, international conventions, standards, classification norms, marine creatures, IMO…
3	**Energy Efficiency Improvements for Aircraft**	Aviation	Technology-driven	Aircraft, fuel, energy, efficiency, engines, ground operations, fleet, aircraft types, aircraft winglets, retrofit, refinement, routes, weight reduction, taxiing, maintenance…
4	**Environmental Performance Assessment**	General	Social-driven	Greenhouse gases, emission volume, calculations, carbon footprint, electricity, energy, verification, energy consumption, office, volume....
5	**Environmental Groups and Committees**	General	Social-driven	Environmental risk, management systems, management teams, committees, meetings, policy, groups, employees, risk management, trends…

LDA results – 18 topics

Topic popularity and correlation

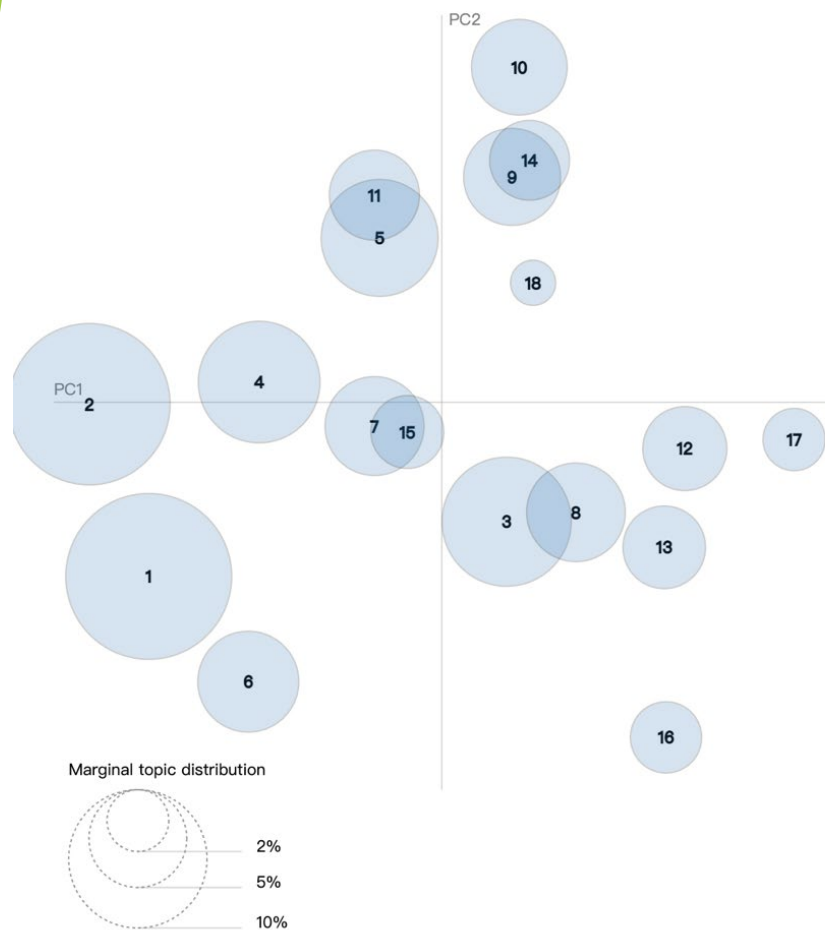Intertopic Distance Map (via multidimensional scaling)

Marginal topic distribution

2%
5%
10%

Topic		Mode	Practice type	High frequency keywords
6	Ship Emissions	Maritime	Technology-driven	Ships, emissions, fuel oil, oxides, nitrogen oxides, emission volume, low sulfur, sulfur content, ozone layer, desulphurization …
7	Fuel Conservation for Aircraft	Aviation	Technology-driven	Aviation, fuel, fuel conservation, aircraft, fuel efficiency, fleet, committees, groups, aircraft type, replacement…
8	New Energy Vehicles	Road	Technology-driven	New energy, vehicles, electric vehicles, intelligent driving, truck models, logistics, automotive, electric, requirements, driver...
9	Green Supply Chain Cooperation	General	Social-driven	Suppliers, customers, waste, recycling, sourcing, materials, supply chain, solutions, commitments…
10	Employee Environmental Training	General	Social-driven	Resources, employees, water conservation, paper, air conditioning, electricity consumption, paper use, recycling, warehouse…
11	Three Types of Waste	General	Technology-driven	Waste, emissions, exhaust gases, disposal, noise, wastewater, reduction, greenhouse gases, collection, recycling, prevention laws...

Topic popularity and correlation

Intertopic Distance Map (via multidimensional scaling)

Marginal topic distribution

- 2%
- 5%
- 10%

| Topic		Mode	Practice type	High frequency keywords
12	**Green Packaging**	Road	Technology-driven	Packaging, express, recycling, environmentally friendly plastic, tape, reduction, usage, bags…
13	**Environmental Certification**	General	Social-driven	Management system, certification, audit, emission reduction, management procedures, improvement, lean, organization, environmental factors, responsible, evaluation, management center, subordinate, structure…
14	**Energy and Consumables Conservation**	General	Technology-driven	Resource consumption, energy, packaging materials, reduction, consumption, indicator, fuel, electricity, effectiveness, efficiency, water, daily, electricity use…
15	**Alternative Fuels**	Aviation	Technology-driven	Biofuel, aviation, facilities, fuel, water, ecology, alternative, airbus, emissions, nature, conversion…
16	**Aviation Carbon Management and Public Engagement**	Aviation	Social-driven	Carbon trading, aviation, carbon offsets, blue sky, flights, emission reduction, compliance, participation, aviation industry, green way, agreement, public interest, foundation…
17	**Environmental Awareness Promotion**	General	Social-driven	Awareness, concept, advocacy, culture, office, topics, public, knowledge, promotion, communication, platforms…
18	**Arctic Navigation**	Maritime	Technology-driven	Arctic, natural resources, shipping lanes, fuel, synergy, cruising…

Findings

- Green practices in the **maritime** logistics sector are primarily centered around **legal compliance** and **energy efficiency**.

- In the **aviation** logistics sector, green practices focus on improving **energy efficiency**.

- The **road freight** sector is prominently concerned with deploying **new energy vehicles** and **green packaging**.

Findings

Topic evolution

Topis in 2015-2016

Intertopic Distance Map (via multidimensional scaling)
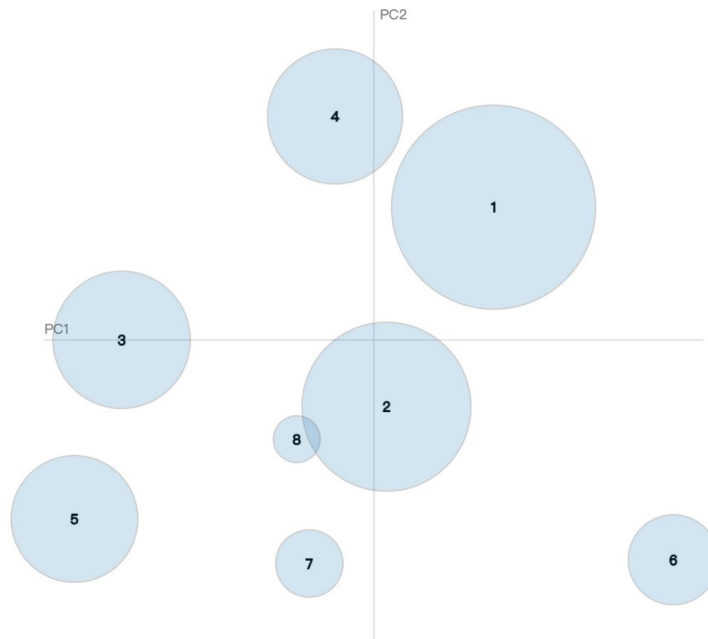
Social Subsystem

Legal compliance

- Topic 2 -Compliance with Regulations

Internal green practice

- Topic 13 - Environmental Management Systems

Internal green practice

- Topic 4 - Environmental Performance Assessment
- Topic 5 - Environmental Committees and Groups
- Topic 10 - Employee Environmental Training

External green practice

- Topic 9 - Green Supply Chain Cooperation
- Topic 16 - Aviation Carbon Management and Public Engagement
- Topic 17 - Environmental Awareness Promotion

Technical Subsystem

Efficiency Improvement

- Topic 1 - Energy Efficiency Improvements for Ships
- Topic 3 - Energy Efficiency Improvements for Aircraft
- Topic 6 - Ship Emissions
- Topic 7 - Fuel Conservation for Aircraft
- Topic 11 - Three Types of Waste
- Topic 14 - Energy and Consumables Conservation

Emerging green technologies

- Topic 8 - New Energy Vehicles
- Topic 12 - Green Packaging
- Topic 15 - Alternative Fuels

Efficiency Improvement

- Topic 18 -Arctic Navigation

Post hoc interviews

Influencing factors of **technology-driven green practices**

The vice president of a listed express firm - "We have invested significantly in the promotion of **hydrogen fuel cell vehicles**. However, the paucity of hydrogen refueling stations outside designated test areas hinders its current application. Nevertheless, we deem **electric light trucks** to have achieved a satisfactory technological maturity, leading us to order 10,000 units, which resonated across China's logistics and automotive industry."

The air transportation director at a major courier express company remarked, "The **sustainable aviation fuel** market, in its current state, is characterized by limited availability and high costs, which deter its immediate utilization." However, as he continued, the company developed forward-looking plans, "We are in the preliminary stages to work with **biorefineries**, eyeing collaborations to amplify sustainable aviation fuel production scales."

The vice president of an express delivery company - "Our organization's decisions regarding green technologies are **not typically driven by policy**. Instead, we lean towards **green technologies** based on their **maturity**. As a technology or product matures, related subsidies tend to decrease or vanish, resulting in a leveled marketplace. Once at this juncture, if the green technology continues to offer financial advantages, we can confidently advocate for increased investment in it."

Technological maturity influences LSPs' adoption of technology-driven green practices. Concurrently, the variation in green practice focus across different transportation modes is closely attributed to the levels of green technology maturity inherent to each operation mode.

Post hoc interviews

Influencing factors of **social-driven green practices**

For social-driven green practices, the interview findings are congruent with the topics derived from our LDA analysis, especially regarding larger listed firms. For instance, three listed LSPs have established **environmental committees** under their board of directors' purview. In contrast, the three non-listed LSPs lack a specialized structure for environmental management.

"The immediate impetus for the environmental committee's inception is our listing on the Shenzhen Stock Exchange, which mandates periodic CSR. Moreover, our foray into socially-driven green practices is inextricably linked to our **brand** and **corporate reputation**."

*Listed LSPs exhibit a higher propensity for socially-driven green practices compared to non-listed LSPs, driven by **market imperatives** and considerations for **corporate reputation**.*

Post hoc interviews
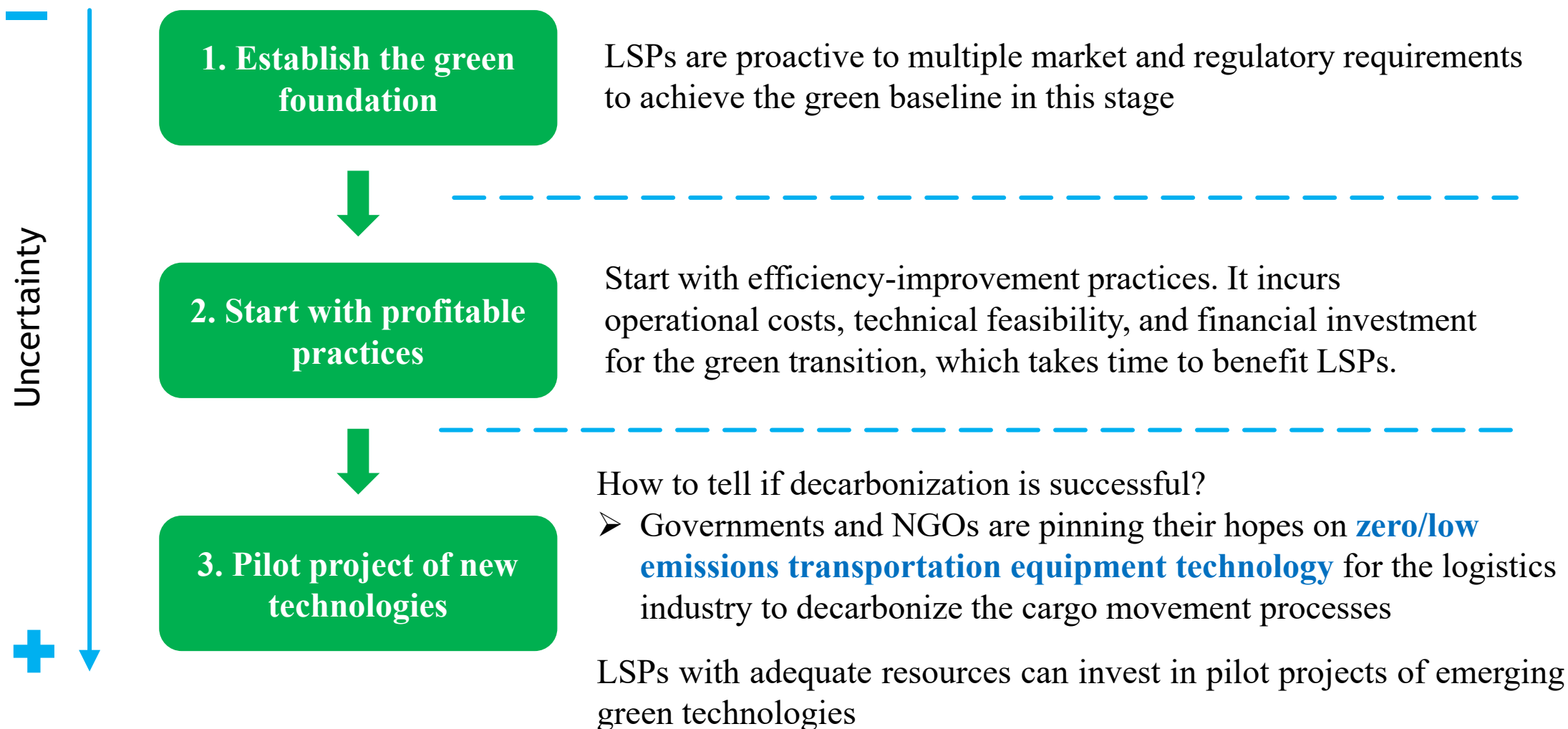## Relationships between technology- and social-driven green practices

One vice president elucidated, "Our approach to adopting green practices has three primary stages. Initially, we immerse ourselves in grasping the pertinent **laws, regulations, standards**, and other guiding documents to set the framework for our green practices. Subsequently, referencing the 'Measurement Methods of Greenhouse Gas Emissions from Express Services' published in 2014, we quantify the company's **carbon emissions**. This **data** becomes the bedrock upon which our green endeavors are anchored. Conclusively, we harness insights from the existing data assessments to pinpoint the **emission reduction** avenues and judiciously select our green practice interventions."

The CTO of an express company mentioned, "To encourage **packaging reuse**, it is essential to establish **recycling points** at final outlets. Coupling this with targeted **marketing and awareness campaigns** can gradually guide consumers toward a reuse mindset. This **behavioral shift among consumers** can, in turn, diminish the costs associated with packaging recycling."

The **synergies** between technology- and social-driven green practices are pivotal for Chinese LSPs

Managerial Implications

Three-stage pathway of green transitions

Uncertainty

1. Establish the green foundation

LSPs are proactive to multiple market and regulatory requirements to achieve the green baseline in this stage

2. Start with profitable practices

Start with efficiency-improvement practices. It incurs operational costs, technical feasibility, and financial investment for the green transition, which takes time to benefit LSPs.

3. Pilot project of new technologies

How to tell if decarbonization is successful?
➢ Governments and NGOs are pinning their hopes on **zero/low emissions transportation equipment technology** for the logistics industry to decarbonize the cargo movement processes

LSPs with adequate resources can invest in pilot projects of emerging green technologies

Thank You

Q&A