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Contemporary Green Solutions for the Logistics and Transportation Industry—With Case Illustration of a Leading Global 3PL Based in Hong Kong

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Abstract: The earth's average temperature has risen by approximately 1.2 °C since the 1900s. The COP26 resolution aimed to achieve carbon neutrality before 2050, while China has committed a more aggressive timetable to actually achieve the goal. It requires either that activities must not release any greenhouse gases or the emitted greenhouse gases must be offset. The logistics and transport activities contribute a lot to global greenhouse gas emissions on Earth. There are a no. of challenges of the logistics industry that are discussed, then the paradigmatic solutions such as green procurement, green packaging, green transport, and green warehousing, are respectively discussed. The three contemporary concepts of green solutions (circular economy, carbon neutrality and green cocreation) for logistics and transportation are explored. Subsequently, a detailed case study of CN Logistics' contemporary green solutions is used to illustrate how to tackle the problems and exemplify the best practices to the other 3PL players. There are expected changes on green directives from the HKSAR Government on logistics green compliances. Finally, this paper concludes with an appeal to the industry to start the green journey immediately.

Keywords: green solutions; circular economy; carbon neutrality; green cocreation

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1. Introduction

The 2021 United Nations Climate Change Conference (COP26) was held in Glasgow in November 2021. The main goal was to secure a global net zero by midcentury and keep a maximum of 1.5 OC of warming within reach. While in China, President XI Jinping declared two directives [1]: (a) Working Guidance for Carbon Dioxide Peaking (before 2030), and (b) Carbon Neutrality (before 2060). It led to the implementation of a new development philosophy in China, influencing key directives in energy, construction, production, transport, etc., for key industries such as coal, electricity, cement, iron, and steel that will be rolled out before 2030. With support from innovative science and technology, a "1+N" policy framework will be established to realize carbon peak and carbon neutrality with a clearly defined blueprint, road map, action plans [2], and timetable.

While in the United States, to monitor the work progress on net-zero pathways towards 2050, the International Energy Agency (IEA) has collaborated with academia and experts from international entities in developing pathways to support the net-zero promise made by the USA and western countries' governments. As can be seen in the orange shade in Figure 1 (Source: Net Zero by 2050—A Roadmap for the Global Energy Sector,

IEA, p. 43), the challenge for China in improving CO_2 emission reduction is the largest of all, and thus requires much extra effort.

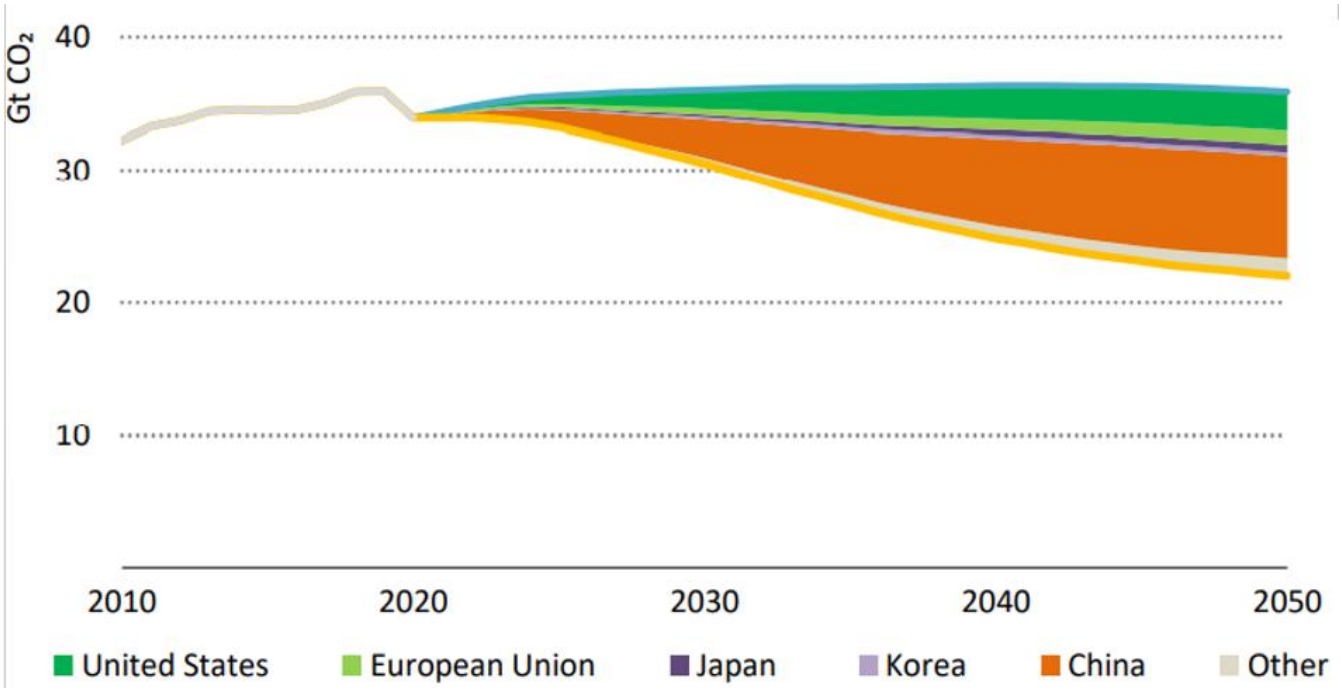

Figure 1. Global energy-related and industrial process CO_2 emissions by scenario and reductions by region, 2010–2050.

According to IEA statistics, on the reliance on fossil fuels, transportation accounts for 37% of CO_2 emissions from end-user sectors [3]. Although transport was one of the industries most seriously affected by the COVID-19 pandemic during 2020 and 2021, with the rebound, increase in demand and the limited adoption of alternative fuels, carbon emissions will resume increasing. This growth is more phenomenal in emerging and developing countries. Putting transport on the track of the IEA sustainable development scenario, a series of policies, termed "avoid, change and improve" [4], are needed to support choosing transportation options with the lowest carbon intensity. Additionally, operational and technical energy efficiency measures should be made to reduce the carbon intensity of all transportation modes.

The Guangdong-Hong Kong-Macau Greater Bay Area (GBA) in China is the most prosperous region in the world in terms of manufacturing and distribution of goods. The 14th Five Year Plan has provided a lot of guidance in improving the transport infrastructure and efficient use of resources in the logistics processes. These macroscopic plans will help in the attainment of the pledged directives [5].

Hong Kong, being one of the member cities of the GBA, ought to follow the lead of the country to realize more green achievements within the specified time frame. In the following sections, more discussions will be focused on the territorial- and district-level considerations.

2. Challenges Facing Green Logistics

The logistics and transportation industry is not recognized as having a high degree of sustainability. Logistics companies face fierce challenges and obstacles in rolling-out environmental policies, mainly due to several causes as shown below:

(a) Insufficient pressure for strict regulatory measures [6]

The process of regulating emission limits and measures is currently undertaken by various governments and authorities. A crossindustry agreement is needed to put such

measures into place to build new processes and facilities that meet the sustainability needs of those involved in logistics activities.

(b) Low motivation to invest [7]

Irrespective of whether the logistics operations are outsourced or carried out inhouse, the tight expenditure rates and thin profit margins generated discourage investment in process automation, smart infrastructure, or more efficient materials handling equipment. This is particularly true for those SMEs.

(c) E-commerce's impact on urban traffic [8,9]

The rising E-commerce order deliveries have greatly increased the no. of last-mile deliveries in cities, and many nonfull load journeys are present when faced with multiple time-definite orders.

(d) Relying on fossil fuels by transport vehicles [10,11]

Economically viable and effective solutions have yet to be searched to wean the transport industry's fossil fuel reliance, particularly for those involving heavy vehicles.

(e) Invisibility of logistics to the customers [12]

In general, logistics is not quite sustainable because neither is the customer. For most customers, logistics is quite invisible. As a result, green logistics policies are difficult to apply when facing same-day deliveries that prevent consolidating orders or making the optimum transport and dispatch flow. Usually, the costs of logistics are not shown or itemized in the invoice or are even already absorbed in the unit selling price. Hence, this reduces their relevance and as a result, lowers the attraction for logistics enterprises to invest in environmental sustainability.

The logistics and transportation industry in Hong Kong mainly comprises many small- and medium-sized enterprises (SMEs) suffering from adverse conditions of high space rental costs and short lease periods, thus discouraging the bosses from long-term investments in sustainability and technology. It is more likely to observe a few small-scale automations or systems that can have a shorter period of payback on the investment.

In particular, with the COVID-19 pandemic effect, the profitability of most logistics activities is not good at all. Unless the green culture and ESG reporting requirement gets deep-rooted into everybody's mindset, there is less push and effect to go towards green in a prompt manner.

3. Paradigmatic Green Solutions

From the perspective of logistics enterprises, a variety of classical paradigmatic green solutions have been studied and practiced. Some are discussed as follows:

(a) Green procurement

'Green Procurement' refers to ordering services and products that lead to minimizing adverse impacts on the environment and human health, thus continually searching for quality products and services at competitive prices.

Green enterprises should consider the environment when procuring goods and services, for example, to prevent items disposal after single-use, and procure products that (i) utilize clean technology and clean fuels; (ii) perform with higher energy efficiency; (iii) improve the ability to recycle, contain more recycled contents, reduced packing, and greater durability; (iv) generate less toxic or harmful substances; (v) emit fewer irritating or toxic substances during use or installation; or (vi) consume fewer water resources.

With the aim to cause less harm to the environment, the process of choosing new materials and resources can create new opportunities and ultimately can reduce the costs of production as well. Moreover, renewable energy production is becoming more efficient and cheaper these days. Hence the no. of 'environmentally friendly' alternative materials increases day by day, and often with lower costs of acquisition.

Local sourcing is preferred as the subsequent logistics and distribution costs will be lower. This will probably discourage globalized procurement practices and incur diseconomies of scale. Big Data systems can also be used to avoid unnecessary procurement, thus reducing waste. The standard of ISO 20400 (Sustainable Procurement) is a good tool in green procurement. Finally, the mandatory ESG reporting for listed companies is also pushing sustainable procurement to extend into the business world and is gradually affecting SMEs as well.

(b) Green packaging

It is also known as an environmentally friendly package. The packaging material may be one of the natural plants and is able to see recurrent or repeated use, and ready for degradation. During its whole life cycle, it is not harmful to the environment as well as to human beings. Green packaging is usually made of renewable resources that can protect the environment and can be achieved by following the guidelines: reduce, reuse, reclaim, recycle, and degradable (also termed as 4R1D).

(c) Green transport and vehicles

There are three approaches to reducing GHGs from transportation [13]: (i) streamlining transport activity, (ii) applying technology, and (iii) using lower-carbon fuels. All of these three are needed to achieve the common targets on the carbon footprint.

(i) Activity and routing

GHGs from transport can be reduced by shifting some goods transport from long-haul trucking to railway or marine ships. By using Big Data, operational research tools, and mathematical models, truck drivers can optimize their delivery routes to shorten routes, increase the quantity of goods transported per trip, minimize the frequencies of empty return trips, and be flexible in managing the fleet.

(ii) Technology

For cars and trucks, reducing weight and improving engine and tire performance are being looked into. Vehicles of advanced technology, all-electric, and hydrogen fuel cell, etc., are fuel-efficient and attain zero harmful emissions

(iii) Fuels

There is a growing no. of lower-carbon fuels in the market these days, and even more are in development. Such new fuels include biological renewable energy (e.g., biodiesel made from microalgae), renewable compressed natural gas (CNG), electricity, and hydrogen.

Hybrid options are available to add convenience in case a fuel type is insufficient to complete a trip. For instance, the most contaminating aviation industry is actively pursuing the use of sustainable aviation fuel (SAF) that can reduce up to 83% of carbon emissions [14].

(d) Green warehousing

Green warehousing aims to lessen its environmental impact through an omni-direction deployment of best practices such as automation, lean warehousing, green building, etc. The achievement can be obtained via:

1. Extensive application of digitization, AI, IoT to enhance automation and become less human-dependent. These days, there is more acceptance of using robotic process automation (RPA) to eliminate repetitive work, e.g., extracting vital information to form an order, updating the checkpoint status, generating customized reports and proof of deliveries, etc.

2. Constantly update available logistics technology and deploy machines with lower energy fuel consumption and pollution (in terms of exhaust gas, noise, heat, vibration, etc.). Replacing forklifts with those running on electricity is a good example. It is a trend to use more AS/RS equipment to make better use of vertical space and fewer materials movement and process flow.

3. Upgrade warehouse lighting with high-efficiency options. LED lighting with controls should be used for many types of lighting applications, including high bay lighting. On average, it can reduce electricity consumption by 30% to 70% from traditional fluorescent lighting.

4. Deploy rooftop or side-wall solar panels for warehouse premises to generate natural electricity. Three main types of solar panels, namely monocrystalline, polycrystalline, and thin-film panels are popularly used. The first one is the most energy-efficient of the three and uses the highest quality silicon. The last one is more flexible to accommodate the shape and contour of the rooftop space.

5. Install some high-volume-low-speed (HVLS) ceiling fans (industrial grade). This is a very effective solution to the warm and humid weather. By adjusting the orientation of the blades, the massive fans will effectively redirect air flows between the ceiling and floor workers.

6. Initiate a recycling program. Warehouse packaging transforms into waste every day such as cardboard, packing materials, wooden pallets, clinging plastic films, etc. A recycling program gives workers a sense of empowerment and contribution to the green warehousing efforts.

7. Go for Leadership in Energy and Environmental Design (LEED) certification for the warehouse building. LEED sets standards for sustainable building design and framework. Hence, it can help in identifying and implementing measurable and practical design, construction, operation, and maintenance of green buildings [15].

Having gone through the above classical green solutions, recently, there is a more contemporary approach that observes the various initiatives from another angle that amalgamates both macro- and microlevel considerations of green solutions for the logistics and transportation industry.

Such green solutions can be grouped under three main categories, namely

(i) Circular economy;
(ii) Carbon neutrality;
(iii) Green cocreation [16].

4. Circular Economy

The concept of circular economy (CE) goes deep into our day-to-day lives. It is based on the fundamental principle of keeping resources and materials taken out from the environment in an economic circuit form, thus lengthening their useful life cycle, and at the same time, preventing their return in the form of waste.

In the value chain, this paradigm allows processes to increase their efficiency and effectiveness, reduce unnecessary consumption, and avoid extracting excessive resources from the earth. Reducing the need for natural resources mitigates human activity's impact on the environment on one hand and stimulates the search for effective usage of resources on the other.

The use of the CE model can be more apparent if we think of solutions that promote the speed and portion of circularity and by applying the several R's in the various stages of the value chain—e.g., the five R's of Refuse, Reform, Reduce, Reuse, and Recycle. Please see Figure 2 (Source: Circular Economy as A Way of Increasing Efficiency in Organizations, the Porto Protocol Foundation, 2020 [17]).

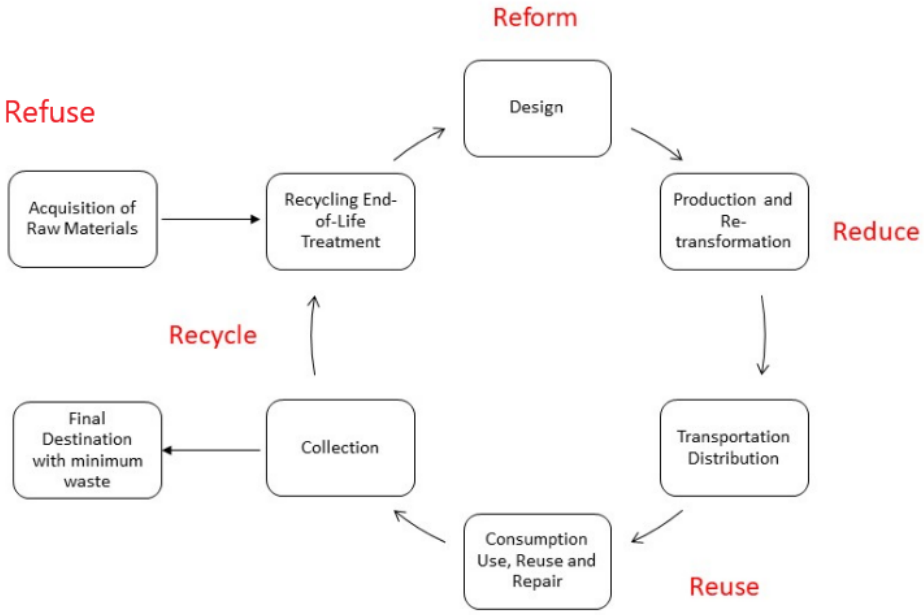

Figure 2. Key elements of circular economy.

All enterprises, one way or the other, realize genuine advantages from the CE practices in various aspects. For instance: during the acquisition of materials, one can generate new thoughts on (a) increasing the efficiency of resource extraction processes and (b) establishing businesses resulting from the product circularity (e.g., those in the recycling industry). ISO 20400 in sustainable procurement standard is a good guidebook for actions.

(a) Product design

Should advocate higher added value through the development of products and services that are new and innovative. The design should not just cover materials and products but also include those during production and service delivery.

Two standards, namely (a) ISO 14044 (Life Cycle Assessment) and (b) ISO 14006 (Ecodesign) provide guidance and help in analyzing the life cycle and values of products and services [18–20].

(b) Production

Good control of production processes can avoid deviations from the specifications, and thus reduce process wastes. The reuse of recycled materials supports circularity while the production of good quality products increases their positive value during their lifespan. Higher production process efficiency will lead to reduced costs; thus, increased profits. The reduction of energy costs and raw materials acquisition, increased yield, and efficiency in production processes will result in a higher added value of the product. There are some control tools for the control of production processes. Standards such as ISO14001 (Environmental Management System), ISO14067 (Carbon Footprint of the Product), and ISO 14046 (Water Footprint) are very good references.

(c) Transport and Distribution

Good logistics practices with intelligent tools can enhance transport and distribution, thus avoiding unnecessary and over-costly journeys. Optimizing such routes can reduce fuel consumption as well as delivery and collection times. Optimizing vehicle repair activities can extend its useful life and achieve effective and efficient use of resources. Continual equipment requalifying and reconditioning will enable the availability in good condition at lower costs. During service provision, the use of remote communication technologies (e.g., tele and video conferences) is advocated to replace physical meetings. This option optimizes the use of time and reduces the response time. In fact, during the

COVID-19 pandemic, a lot of communications have already been forced to adapt to this "new normal". Local trading is preferable to international since it advocates logistics agility and values chain mobility and fosters closer relations amongst various business parties. Finally, ISO 14067 (Carbon Footprint of Product) can correctly appraise the process efficiency of the transport and distribution.

(d) Consumption, Use, Reuse, and Repair

End consumers define the market needs and reducing consumption needs will avoid unnecessary production and waste disposal. Adequate repair and maintenance prevent the equipment from incurring scraps and often operates more promptly with reduced costs.

Leasing instead of owning equipment or tools makes better use of their lifetime. Additionally, it can reduce the total cost of ownership (including acquisition costs, maintenance costs, insurance, taxes, etc.). In fact, much of what we own has a comparatively low usage rate, e.g., vehicle fleet, security guarding and customs clearance, etc. Such service leasing or chartering can create new businesses that facilitate the circularity principles.

Using a resource other than for its original primary purpose is also a solution for many products. This is of growing popularity and prevents many products from becoming waste before their permanent destruction (e.g., use of tires as pavement materials, pallets used for furniture, bottles as vases, etc.).

(e) Collection, Recycling, and End-of-life Treatment

When all the other solutions are exhausted, then will emerge the last R (Recycle). At this stage of the CE process, the possibility and potential of using the item as a renewed raw material will be considered. As such, a residue can be treated as a raw material in a new form of resource of comparable quality. Packaging paper and corrugated cartons are good illustrations since the wood fibers can be reused for many cycles. This can be achieved by increasing the ingredient percentage of recycled inputs, the yield and efficiency of the treatment processes, and the lowering of conversion costs

When collecting resources, the process should observe regional realities and network maps. A superb collection methodology in downtown may not suit the rural areas, and vice-versa.

It is better that the products should have fewer types of material composition to have more efficient segregation and recycling processes. Standards for End of Waste status can help better control the quality of recycling waste.

End-of-life treatment is the final point for resources that cannot go through the 5R cycle. Such quantity should be kept to a minimum in order not to disrupt the circular economy. The end-of-life treatment operations control needs to be commensurate with its impacts. Suitable technologies should be used to minimize unfavorable effects on the environment.

5. Carbon Neutrality

Carbon neutrality is a balance between emitting and absorbing carbon from the atmosphere in the earth (carbon sink). Carbon sequestration means to remove carbon oxide from the atmosphere and store for future use. The global greenhouse gas (GHG) emissions will be balanced by carbon sequestration to achieve net zero emissions.

Carbon sink is a system to absorb more carbon than it emits, e.g., soil, forests, and oceans. These natural sinks remove around 10 gigatons of carbon dioxide annually. Around 38 gigatons was emitted in the world in 2019. Nowadays, only natural carbon sinks can remove carbon from the atmosphere to fight global warming.

The global logistics and transportation industry relies on container ships and heavy vehicles to transport the goods to their destination. Both ships and heavy vehicles are predominantly using diesels to be the power source. The combustion engines emit a large amount of CO_2 and other greenhouse gases. For the heavy vehicle, it is one major source of carbon emission, the average emissions amount of a heavy vehicle is around 52.7 grams

of CO_2 per ton-kilometer (gCO_2/tkm). The shipping emits around 940 million tons of CO_2 annually. It is around 2.5% of the world's total CO_2 emissions. Although the automotive manufacturers are developing the hydrogen or electric power-driven heavy vehicle, the technology needs more time to become mature and reliable.

The carbon footprint is expressed as carbon dioxide equivalent (CO_2e) and defined as the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, or product. GHG, including the carbon-containing carbon dioxide and methane gases, are emitted through the burning of fossil fuels, manufacturing processes, consumption of manufactured products, goods transportation, and other services. The carbon footprint (CO_2e) is calculated with the amount of GHG emission and the global warming potential (GWP), as shown in Table 1.

Table 1. Greenhouse gases and global warming potential.

Emission	Chemical Formula	GWP (over 100 Years)	Sources
Carbon dioxide	CO_2	1	Combustion processes
Methane	CH_4	25	Landfills, coal mining, wastewater treatment, biomass combustion
Nitrous oxide	N_2O	298	Agricultural soils and nitric acid production
Hydrofluorocarbons		124–14,800	Substitutes for ozone-depleting substances, semiconductor manufacturing
Sulfur hexafluoride	--	22,800	Electrical transmission and distribution
Perfluorocarbons		7390–12,200	Substitutes for ozone-depleting substances, semiconductor manufacturing

GHG emissions are determined by multiplying GHG activity data (e.g., electricity consumption for a machine) with emission factors (EF) (e.g., CO_2 emissions per GJ/natural gas). The unit of measure is metric tons, and all GHG emissions are converted to tons of CO_2e, using the 100-year GWP factors as published in the Sixth (2021) Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

In order to improve the carbon footprint, there are several ways for industrialists to act, such as good refrigerant management. Over 90 billion tons of CO_2e will be produced from 2017 to 2050. The traditional refrigerants are major greenhouse pollution sources and have thousands of times the warming potential. Alternative green power sources, e.g., land-based wind turbines for electricity (85 billion), reduced food waste (71 billion), and restoring tropical forests by prohibiting the use of the land for other purposes (61 billion) are other possible solutions to improve carbon footprint. An enterprise's carbon footprint is influenced by various factors such as offsite electricity generation, energy sources, and materials.

The Singapore government established the carbon tax, the carbon emitters have to pay for each ton of greenhouse gas emissions. It drives businesses and consumers to switch to alternative fuels or adopt new technologies in order minimize the carbon emissions to avoid paying heavy taxes.

6. Green Cocreation

The green cocreation process can be seen as value creation involving different stakeholders, such as suppliers and customers. Both the supply network and the customer network formed a value cocreation process to provide a possible solution for the service business environment. Each of these actors takes part in adding value to the life cycle (see Figure 3, Source: L. Trevisan, Service Delivery and Co-Creation to support Value and Sustainability in PSS design [21]).

Figure 3. Cocreation of actors to add value.

Green value cocreation is a process of exchanging environmental ideas among customers and suppliers to achieve sustainable value [13]. It is the continuous process of value cocreation from both the supply and demand sides in a virtuous circle form. Sustainable value for the society is related to the closed-loop cycles of the provider who regenerate materials and offer them to new customers instead of direct disposal. The efficient design of service delivery enhances the cocreation process so that they satisfy the issues of sustainable value creation. Indeed, the correct design of service delivery will help organize the life cycle in a closed-loop approach supported by learning and cocreation.

It will also help to efficiently manage resources during usage. During interaction with the customer, the potential of the value proposition will be confronted with the reality of value creation by facing the complexity of human behavior. Success depends on the ability of the provider to cocreate value with the customer. This cocreation process corresponds to a win-win relationship where customer behavior must be understood and guided in a process where actors are voluntarily involved and satisfied. Finally, sustainable value emerges from a life-cycle perspective of a production network and consumption activity. Sustainability is intrinsically linked to the value of services provided by natural and human systems.

In view of environmental deterioration and resource shortage, many governments are launching campaigns to guide enterprises to adopt and implement green innovation. Nevertheless, for a lot of SME companies, the high investment cost of green innovation makes it difficult to achieve green goals by themselves. Hence, there is a growing number of companies cooperating with their supply chain partners on green solutions.

The above three contemporary green concepts can be more readily evidenced and illustrated through a case study on a leading logistics and transportation enterprise on how they manage these three contemporary green solutions.

7. Case Study of CN Logistics' Green Solutions

CN Logistics (CNL) is a listed company (Stock Code: 2130.HK) on the Hong Kong Stock Exchange. They are a well-established logistics solutions provider (sometimes also referred to as 3PL) with 18 global offices and over 600 highly-skilled direct employees in Hong Kong. CNL has a vision of being the world's leading integrated global logistics solutions provider in the high-fashion industry and other emerging opportunities.

The top management has tailor-designed their own green solutions to protect the Earth by reducing the environmental impacts of business practices and operations. They offer customized solutions for their clients and partners to streamline sustainable implementations at different stages of the supply chain. The main initiatives leading to their green solutions include (a) one-stop green logistics solutions; (b) sustainable supply chain and waste reduction at source; (c) investing in green transportation; (d) partnerships to reduce, reuse, recycle, and recreate recycled materials; (e) carbon consultation, statistical assessment, and carbon offset; and (f) contributing to renewable energy projects.

In implementing the above, they would first collect the concerned items cost-effectively, predominantly paperless and also with simplified operations. Then, they would sort the items by well-trained staff to maximize the yield of recyclable materials. CNL sorts clothing into five categories, namely, (i) wearable clothing; (ii) wearable accessories; (iii) unwearable clothing and nondonateable clothing; (iv) wearable nondonateable clothing; and (v) landfill materials. Different treatments and processes will apply to the different categories above. Then, the process of recycling is undertaken by well-equipped recycling partners. Subsequently, the materials would be consolidated cost-effectively to aim at having zero landfills, if possible.

Finally, all the above processes would be summarized, cost analyzed, and project reviewed to make it a sustainable action. ISO 14064-3 is used as a guideline for meeting the Corporate Value Chain (Scope 3) Accounting and Reporting Standard of the GHG Protocol [22,23].

In addition to the first batch of electric vans being launched into use in 2018 that was mainly dedicated to domestic courier services within Hong Kong, CNL has also started to have three more electric trucks (5.5-ton capacity) since May 2022 for a wider deployment of green vehicles for all their other transportation needs. This is a pioneer in Hong Kong of using electric trucks for genuine operations (See Figure 4).

Figure 4. New deployment of three 5.5-ton electric trucks in May 2022.

Regarding the three contemporary green solution concepts, namely, circular economy, carbon neutrality, and green cocreation, CNL also has aggressive and enforceable actions to realize these in the logistics and transportation arena. They will be discussed in turn below.

The implementation of the circular economy model in the supply chain practices has resulted in waste reduction. This has contributed to reducing, reusing, recycling, and recreating paper, plastics, electronics, garments, and other materials. Since the inception of such an initiative in 2018, there has been a phenomenal increase in materials recycled. Table 2 shows the development over these years.

Table 2. Volume of recycled materials and parts. Source: CN Logistics.

Units in Tons	2018	2019	2020	2021
Participating Clients	5	13	15	25
Plastic Hangers	3.71	5.87	35.62	25.60
Plastic Polybags	1.26	14.80	24.06	30.05
Cardboard/Paper	32.55	253.44	350.75	423.32
Electrical, Clothing and Others	0	0.9	1.84	39.58
Total	37.52	275.01	412.27	518.55

Inspecting the full 4-year period, the total recycled volume in 2021 is 13.82 fold that of 2018. If the most recent three years are considered, the CAGR is 37.35%, indicating that the growth rate is significant. For the first quarter of 2022, the momentum is still strong, at a 30% to 35% increase rate over the previous year.

At the same time, the no. of clients participating in this circular economy program also increased significantly from 5 in the first year to 25 in 2021. This indicates that more clients buy this concept, and more or less follow the green procurement concept to cooperate with "green companies".

Actually, CNL pays for the transportation costs of collecting, transferring (to recycling partners), and disposing of the above goods and materials at no charge to the clients. This calls for their improved route planning of the trucks as well as higher load utilization of the vehicles.

In terms of carbon neutrality, free statistical consultation is provided to the clients. Carbon footprint measurement is verified by ISO 14064-3 on the emissions methodologies, account, and reporting standards for logistics and inhouse carbon. While the efficient use of resources and minimizing damage to the environment is verified by ISO 14001. Table 3 shows the measured carbon footprint for CNL itself as well as four other clients for the fiscal year 2020/2021.

Table 3. Measured carbon footprint (unit in Kg CO_2e). Source: CN Logistics.

Month	CNL	Brand A	Courier A	Courier B	Courier C	Total
April 2020	238,462	38,039	7357	10,178	578	294,614
May 2020	227,779	65,596	10,498	16,921	992	321,786
June 2020	329,591	150,668	12,689	40,953	2561	536,462
July 2020	675,017	120,293	20,230	85,580	6347	907,467
August 2020	752,442	75,437	12,635	22,430	1623	864,567
September 2020	745,372	63,215	16,241	15,054	894	840,776
October 2020	562,129	53,697	20,504	11,857	927	649,114

November 2020	760,361	65,010	19,792	11,248	927	857,338
December 2020	902,230	124,511	26,465	74,519	3571	1,131,296
January 2021	752,851	59,875	22,853	122,191	4095	961,865
February 2021	522,538	31,795	20,009	28,264	998	603,604
March 2021	563,987	40,622	16,895	12,610	632	634,746
Total	7,032,759	888,758	206,168	451,805	24,145	8,603,635

CNL holds certificates issued by the United Nations Framework Convention on Climate Change in accordance with the procedure for voluntary cancellation in the Clean Development Mechanism (CDM) Registry and commits to contribute to climate action and offset carbon dioxide emissions through trustworthy climate friend projects. During the same period, four such certificates have been bought (See Table 4).

Table 4. Four rounds of Carbon Offset Certificate issued. Source: CN Logistics.

Order Number	Certificate Reference	Issued Date	No. of Units Canceled (Tons of CO_2)
15284	VC15284/2020	24 June 2020	1000
16457	VC16457/2020	10 November 2020	1462
16891	VC16891/2020	15 December 2020	1242
18892	VC18892/2021	30 April 2021	2699
			6403

From the statistics, the incurred carbon footprint is 8604 tons against an offset of 6403 tons, leaving a balance of 2201 tons to be further canceled in the near future. While the carbon footprint can be offset via monetary payout, the main emphasis is still on decarbonization. In other words, generate less, and pay less.

A sample voluntary cancellation certificate is shown in Figure 5.

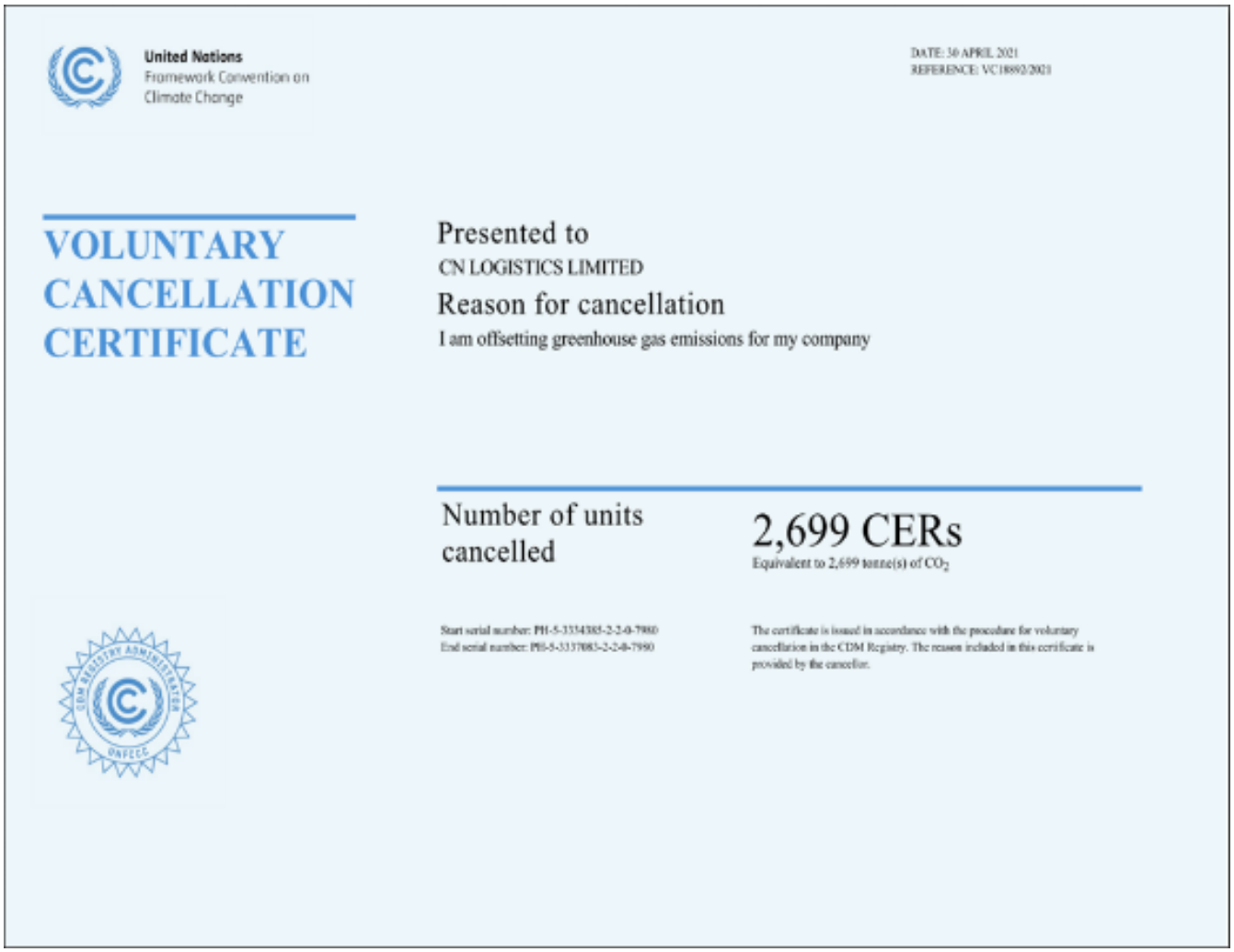

Figure 5. A sample voluntary cancellation certificate. Source: CN Logistics.

Finally, for green cocreation, there are three main work directions at CNL, described as follows.

(1) Cocreate sustainable business practices with globally renowned brands to build customized solutions.
(2) Connect with green enablers specialized in processing the recycling, recreating, and donating of different types of material such as Redress, Alba IWS, etc.
(3) Sponsor and participate as a member of the Business Environment Council (BEC) that advocates sustainability in enterprises and connect with the Hong Kong SAR Government to exchange green insights, propose policy implementation, funding support, and share the needs and challenges of businesses in driving green and sustainability.

Coincidentally, the three green solutions above also contribute to the United Nation's Sustainable Development Goals: (a) circular economy hits Goals No. 11 (Sustainable cities and communities), 12 (Responsible consumption and production), 13 (Climate action), 14 (Life below water), and 15 (Life on land); (b) carbon neutrality hits Goal 7 (Affordable and clean energy); and (c) Cocreate green hits Goal 17 (Partnership for the goals). They have hit 7 out of the total 17 goals under such UN goals.

It can be seen from this case study that CNL has pioneered reaching out to various clients and partners to execute policies and plans that can lead to a more sustainable business operation. This contributes to the entire 3PL industry of Hong Kong. Since at this stage, not many legislations or rules are enacted by the government to follow the national

or global commitment, a few years back, the company directors and management started all these voluntarily. This needs unwavering determination, bold courage, as well as some initial investments.

On top of the comfort of truly contributing to preserving the Earth, there are also some benefits such as a positive corporate image, more brand loyalty from the clients, increased employee pride, motivation, and satisfaction, and ultimately money will be saved as resources are saved and more effectively used. This is also a good lesson for other logistics and transportation industry players to benchmark and develop their own green solutions. It can be anticipated that many other new approaches and means of achieving sustainability will be seen in the near future.

8. Conclusions

This paper has covered the current situation and challenges towards a greener environment and path towards net-zero carbon emission. It is evident that there is a strong quest for green solutions for sustainability. It is particularly challenging for the logistics and transportation industry where many SMEs are struggling for survival. It is even more challenging in the case of Hong Kong due to the adverse conditions of high space leasing costs and short time periods, thus discouraging long-term investments in sustainability and technology.

Various classical paradigmatic green solutions have been discussed, mainly along with four perspectives, namely, green procurement, green packaging, green vehicles, and green warehousing. A no. of points were discussed, and quite a no. of the methods and tools are being used and practiced.

Three newer thoughts of green solutions are (a) circular economy, (b) carbon neutrality, and (c) green cocreation.

Circular economy applies the various R's in the value chain, namely, refuse, reform, reduce, reuse, and recycle. These can gain advantages in materials acquisition, product design, production, transport and distribution, consumption, use-, reuse, andrepair, collection, recycling, and end-of-life treatment. Carbon neutrality focuses on the measurement and reduction of the carbon footprint. In order to achieve net zero emission, it requires to balance between emitting and absorbing carbon from the atmosphere. Carbon sequestration shall be applied to counterbalance global GHG emissions. Green value cocreation is an exchange of environmental ideas among customers and suppliers to achieve value via virtuous circle types of discussions, thus letting them learn from each other. Many SME firms would like to cooperate with their supply chain partners who are experienced in green innovations to gain savings more cost-effectively rather than fighting on their own.

In the case study, the researched 3PL is dedicated to deploying and practicing their green solutions that fit the logistics and transportation industry. They extend the concept from what should be done to how to do it, thus reaching out with the first few steps. Though the Hong Kong SAR government has not yet announced any harsh directives and laws, the logistics and transportation industry, being one of the "main polluters", should take the initiative to start off themselves. It is noted that the new Chief Executive of the Hong Kong SAR government has planned to change the administrative organization to set up a separate Transport and Logistics Bureau. This can better lead the function, and some major changes in the policy, initiatives, and actions are expected to come soon,

CNL is spending money on pursuing all these green solutions and seeking clients and partners to join the league. They are confident that the ultimate benefits gained can make such investment worthwhile, and also ultimately make more profits. CNL also wishes their green movements can invoke other industry practitioners to take action also so as to start the journey of carbon dioxide topping in 2030. There are just less than 8 years to attain the goal, definitely, no more time can be wasted!

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