



Green Supply Chain Management : Logistics and Distribution



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Contents

1. Introduction	4
1.1. Overview	4
2. Why A Green Supply Chain Matters	5
2.1 Green Supply Chain Management: Compliance to Value Creation	6
2.2 Organizational View on Green Supply Chain Management: A Strategic Analysis Tool	7
2.3 Benefits to Industry	7
2.4 Green House Gas Emission: Government Compliance PAS 2050	8
3. Current Industry Scenario	8
3.1 Inbound Operation	8
3.2 Outbound Operation	9
4. Problem Statement & Solution	9
4.1.1 Connectors	9
4.1.2 Consolidators	9
4.1.3 Planners	10
5. Use Case Scenario	10
5.1 Calculation method - Present Scenario	11
5.2 Calculation - Daily Planned Schedule	12
6. Benefits	12
7. Conclusion	13
8. References	13
9. About the Author	14



1. Introduction

In early environmental management frameworks, operating managers were involved at the organizational level. Specialized organizational units had the responsibility for ensuring environmental excellence in product development, process design, operations, logistics, marketing, regulatory compliance, and waste management.

In recent times, Green Supply Chain Management (Green SCM) is gaining significance among manufacturers due to the following reasons:

- Diminishing raw materials
- Deterioration of environment
- Overflowing waste lands
- Increasing levels of pollution

In today's competitive world, it is not only about being environment friendly but also about better business sense and profits.

The Supply Chain System (SCM) includes purchasing, inbound logistics, production, distribution (outbound logistics and marketing), and reverse logistics.

The first three categories are part of the well-known value chain concepts. The last functional element, reverse logistics is one of the most recent areas of focus in the supply chain.

1.1. Overview

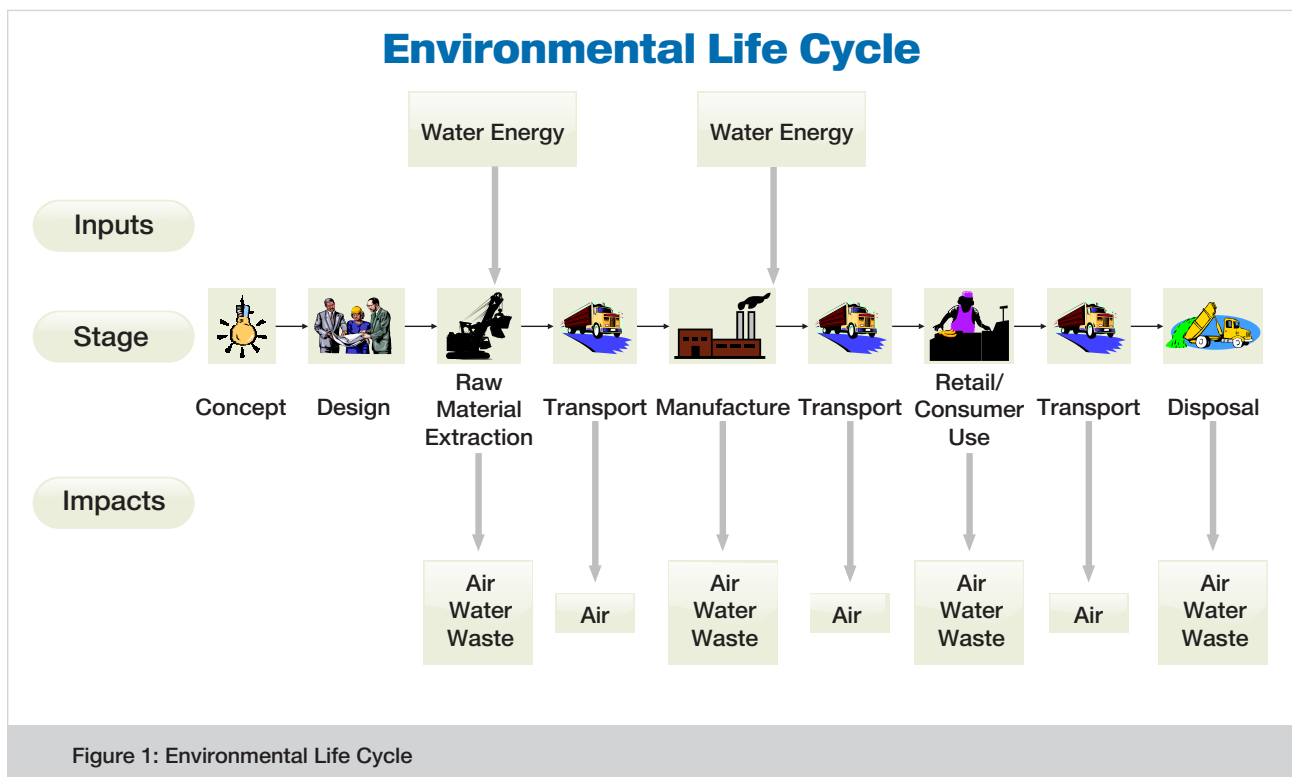
Confronted with global resource exhaustion and increasing environmental deterioration, enterprises cannot ignore environmental issues in today's business. Economic globalization and pressure from the public, laws, and environmental standards are forcing and driving enterprises to improve their environmental performance as well.

Green SCM is getting more attention as a sustainable development mode for modern enterprises and is increasingly a part of Corporate Social Responsibility (CSR) initiatives.

2. Why a Green Supply Chain Matters?

Government regulations and customer demands are making environmental responsibility an increasingly important factor in everything from materials procurement to distribution. Many companies share the current widespread concerns for the health of the planet. Hardly few of them, unfortunately, have successfully translated those concerns into action by adopting environmentally sustainable, green supply chain practices. Businesses worldwide continue to use toxic chemicals, wasteful packaging, and transportation practices that produce clouds of gases that may contribute to global warming.

However, from materials acquisition and manufacturing to packaging, logistics, and distribution, every stage of the supply chain offers opportunities to reduce waste and pollution.



Regulatory mandates on environmental pollution and greenhouse gas (GHG) emission increasingly require companies to adopt greener practices. Such laws have business decision makers examining both their own operational processes and those of their suppliers. Organizations can be held liable for the ecologically irresponsible actions of their vendors in a court of law, the court of public opinion, or both.

Moreover, suppliers with lax of environmental policies are likely targets for government prosecutions and even shutdowns, which can impede their ability to fulfill customer orders as well as manage reputation risk.

2.1 Green SCM: Compliance to Value Creation

Green SCM integrates Environmental Management and Supply Chain Management. It recognizes the disproportionate environmental impact of supply chain processes in an organization.

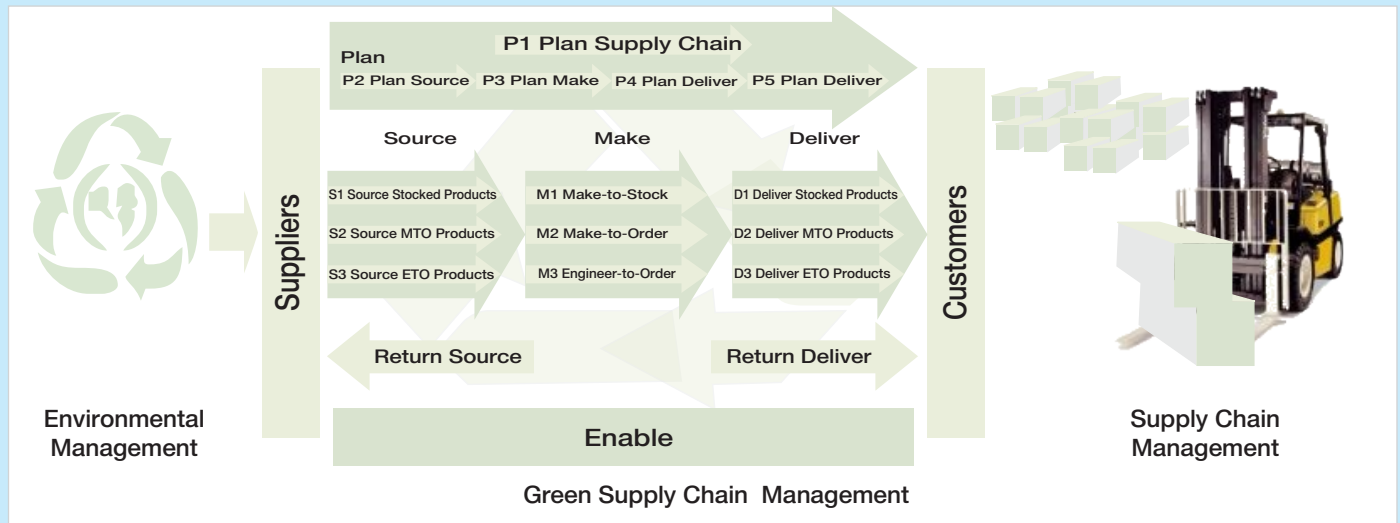


Figure 2: Compliance to Value Creation

There are straightforward, low-cost activities that every business can do to make a positive difference to the environment. The usual focus of these efforts is on changes within the business, but supply-chain choices can have an important effect too. Simply put, what you decide to buy and whom you decide to buy from can make a difference.

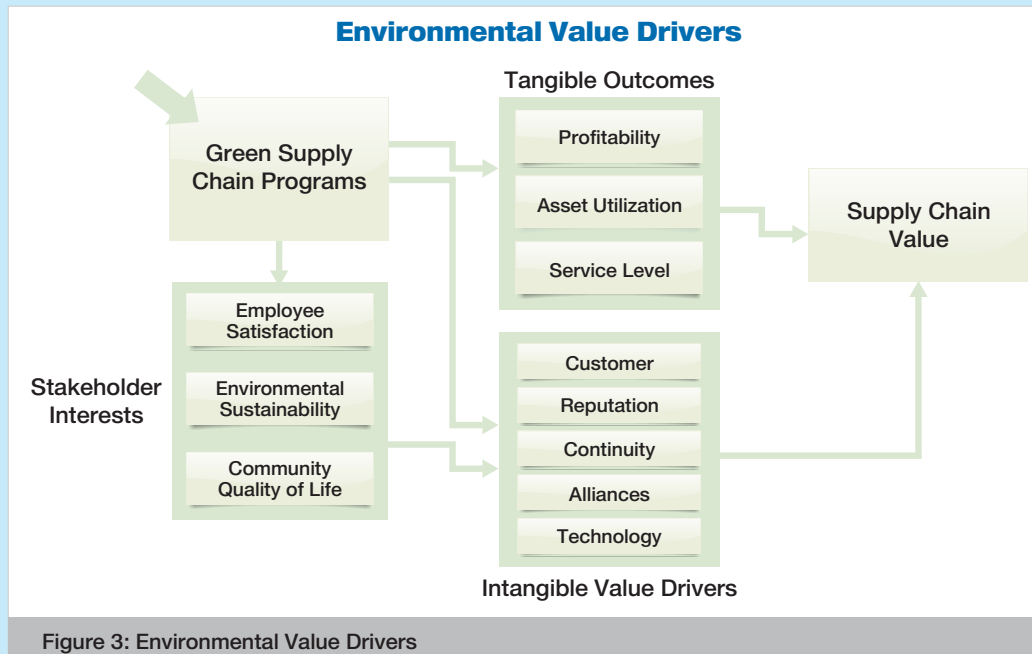


Figure 3: Environmental Value Drivers

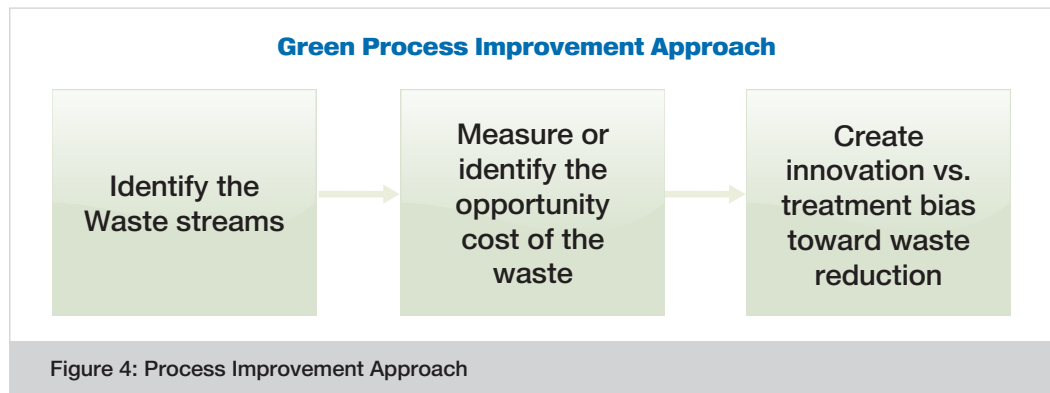
In Summary

- Though regulations increasingly make environmental responsibility mandatory, compliance can provide a competitive advantage.
- Careful planning and self-evaluation should be the starting points of any green supply chain initiative.
- Implement green supply chain reforms internally before asking suppliers to comply as well.

2.2 Organizational View on Green Supply Chain Management: A Strategic Analysis Tool

In general, pollution and waste represent incomplete, ineffective or inefficient use of raw material. Green Supply chain analysis provides an opportunity to review processes, materials and operational concepts. As with continuous improvement programs, green supply chain analysis targets:

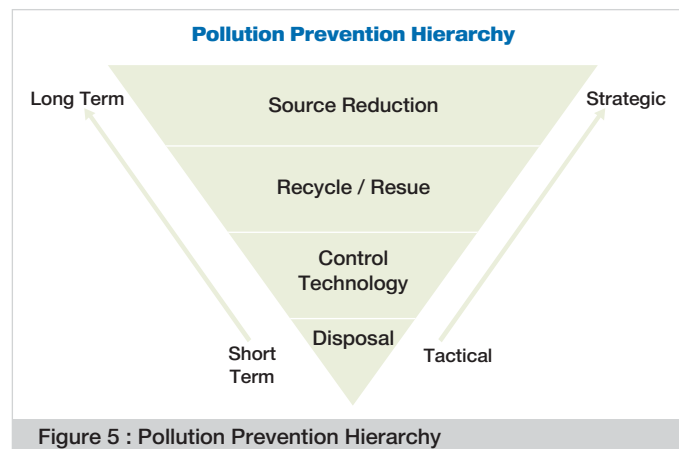
- Waste material
- Wasted energy or effort
- Under-utilized resources



Today, OEMs are encouraging their suppliers to adopt green practices, environmental management systems, etc. Focus is on the material content and environmental practices to be adopted.

2.3 Benefits to Industry

The business benefits of environmental improvement are getting progressively clearer. The more businesses and consumers take environmental issues seriously, the greater the gains to be made.



There are two main types of business benefits. First, there are potential cost reductions. Environmental change often boils down to increased resource efficiency, which in turn leads to improvements to the bottom line. Secondly, benefit relates to customer preferences and enhancing corporate reputation. More and more businesses and consumers are using environmental issues as a criterion in their purchasing decisions, so progress in this area can lead to increased sales and marketing activities.

2.4 Greenhouse Emission: Government Compliance PAS 2050

Greenhouse gas emissions are fast becoming a key consideration for customers, regulators, and supply chain partners. Credible demonstration of assessing or reducing emissions can provide a competitive advantage, helping you win contracts and customers. Importantly, it also demonstrates a commitment to prevent climate change.

PAS 2050 is a publicly available specification which provides a consistent method for assessing the life cycle GHG emissions of goods and services. It does this by providing a set of requirements intended to benefit organizations, businesses, and other stakeholders by providing a clear and consistent method for the assessment of the life cycle GHG emissions associated with goods and services.

For organizations that supply goods and services, the following are the benefits:

- Allows internal assessment of the existing life cycle GHG emissions of goods and services
- Facilitates the evaluation of alternative product configurations, sourcing and manufacturing methods, raw material choices, and supplier selection on the basis of the life cycle GHG emissions associated with goods and services
- Provides a benchmark for ongoing programmes aimed at reducing GHG emissions
- Allows for a comparison of goods or services using a common, recognized, and standardized approach to life cycle GHG emissions assessment
- Supports reporting on corporate social responsibility

3. Current Industry Scenario

The current industry scenario highlights on the logistics activity in a typical inbound operation and outbound operation within the OEM and its effect on the environment and SCM.



Figure 6: Current Industry Scenario

3.1 Inbound Operation

The inbound logistics in a typical manufacturing environment is based on the scheduled receipt of goods by the OEM against the purchase orders given to the vendors. Based on the scheduled deliveries, the vendor sends invoices along with the consignment to the manufacturer.

On reaching the manufacturers premise, the transporter registers the invoice and the manufacturer accepts the goods. Based on that, the OEM application generates an acceptance note and unloads the goods.

After unloading goods, the empty vehicle moving out of the OEM premises adds to the increase in the level of environmental pollution.

3.2 Outbound Operation

The outbound logistics deals with the scheduled dispatches to dealers which is an ongoing activity at the OEM premises. Based on the readiness of the goods, dealers orders get consolidated, logistics is planned, invoice is generated, and the required load carrier is arranged.

The transportation is arranged through a third party logistics agency as per the load determined by the application; and the carriers will be called and loaded. The empty vehicles check-in for dealer dispatches after a long waiting period due to traffic congestion and urban mobility factors. This leads to local air pollution, improper resource utilization, excess storage, and operating cost.

4. Problem Statement & Solution

The vehicle enters the OEM premises for delivery of the scheduled receipt of goods from the vendors. After unloading the goods the empty vehicle moves out of the OEM premises.

A solution can be developed to integrate the Due-in and Due-out of schedules of deliveries and plan accordingly for vehicles.

Develop a set of connectors that will pull the due-in schedules from the vendors. This is possible as most of the vendor supplies based on scheduled deliveries are mentioned by the OEMs.

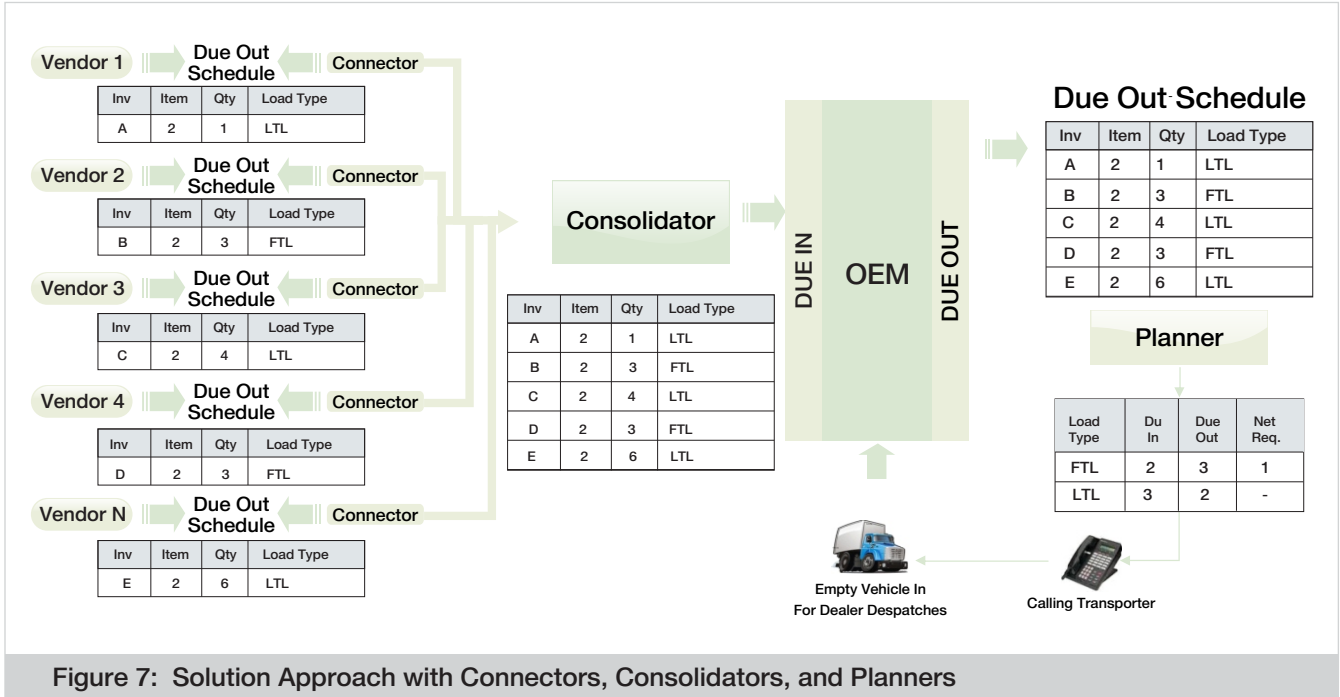


Figure 7: Solution Approach with Connectors, Consolidators, and Planners

4.1.1 Connectors

The connectors should be synchronized with the Due-out schedules of the vendor on a batch mode and should be consolidated. The mandatory fields that need to be fetched by the connectors should be invoice number, item number, quantity, and load type (FTL/LTL).

4.1.2 Consolidators

The consolidator should be collating the data-fetch by the connectors in a batch mode, and supply the information to the respective OEM application. Similar to the Due-in schedule from the vendors, the OEM should be having their Due-out schedules which determine the information on dealer dispatches. The Due-out schedule should clearly determine the load type (FTL/LTL).

4.1.3 Planners

The planner should consolidate the Due-in data (from vendors) and Due-out data (dealer dispatches) and calculate the net requirement of vehicles. This should also be done in a batch mode.

During this process the planner should consider the vehicles based on the load type during the scheduled receipts from the vendors and compare it with the vehicle load type required for the dealer dispatches.

The following are the business benefits from the solution:

- Reduced transportation cost
- Improved inbound in-transit visibility
- Improved efficiencies in handling goods receipts
- Improved communication with all parties involved
- Efficient collaboration with logistics service providers

5. Use Case Scenario

The case study for the implementation of the daily planned schedule is elaborated. The vendors, dealers, and logistic service providers are located at a varying distance from the OEMs. Based on the Due-in for the scheduled receipt of goods by the OEMs from the vendors and the Due-out for the schedule dispatch of goods from the OEMs to the dealers, the FTL/LTL are hired. Based on the comparison of the Due-in and Due out the net requirement is calculated in the Daily Planned Schedule.

There are four vendors and the details about the activities of the vendors are given here:

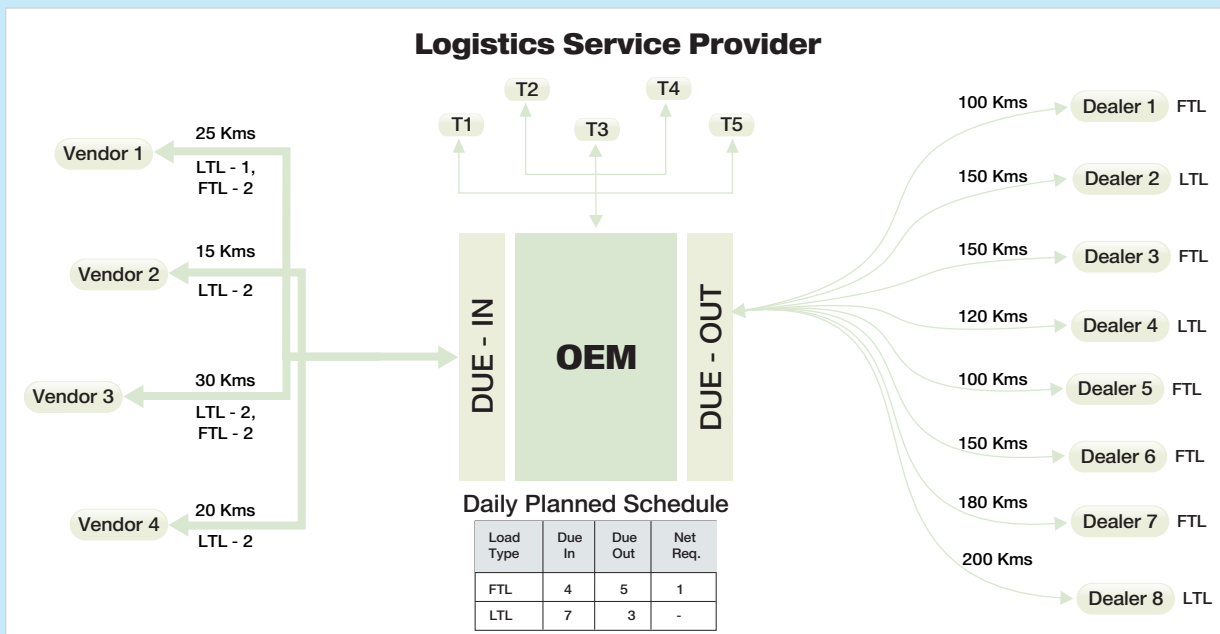


Figure 8: Model Architecture

Vendor 1, located at a distance of 25 kms from the OEM, sends 1-LTL and 2FTL

Vendor 2, located at a distance of 15 kms from the OEM, sends 2-LTL

Vendor 3, located at a distance of 30 kms from the OEM, sends 2-LTL and 2FTL

Vendor 4, located at a distance of 20 kms from the OEM, sends 2-LTL

There are eight dealers situated at a distance of around 100 to 200 Kms for the scheduled dispatch of goods from

There are five logistics service providers situated at an average distance of 50 Kms from the OEM.

As per the summation of the daily planned schedule, the FTL and LTL requirements are given here:

Full Truck Load (FTL)

The due-in for the scheduled receipt of goods from the vendor is four FTL, and the due-out requirement is five FTL

Less than Truck Load (LTL)

The Due-in for the scheduled receipt is seven LTL and the Due-out requirement is three LTL

In the present scenario the OEM orders for five FTLs and three LTLs from the logistic service provider based on due-out requirement.

But now with the daily planned schedule ordering, pattern will be one FTL and 0 LTL from the logistic service provider. The requirement of five FTLs and three LTLs should be managed with the due-in vehicles from the vendors.

5.1 Calculation method (Present Scenario)

(In INR)

Dealer	Load Tp.	Kms	Rate / Kms	Total
D1	FTL	150	15	2250
D2	LTL	200	10	2000
D3	FTL	200	10	3000
D4	LTL	170	10	1700
D5	FTL	150	15	2250
D6	FTL	200	15	3000
D7	FTL	230	15	3450
D8	LTL	250	10	2500
Kms = Distrance between Transport to OEM+			Grand Total	20150
Distance between OEM to Dealer			Total Kms	1550

FTL Rate/Km = Rs.15 and LTL Rate/Km = Rs.10
Formula:
Dn = (Distance between Transporter to OEM + Distance between OEM to Dealer) * Rate/Km (FTL/LTL)

(In USD)

Dealer	Load Tp.	Kms	Rate / Mile	Total
D1	FTL	150	7.00	1050
D2	LTL	200	6.50	1300
D3	FTL	200	7.00	1400
D4	LTL	170	6.50	1105
D5	FTL	150	7.00	1050
D6	FTL	200	7.00	1400
D7	FTL	230	7.00	1610
D8	LTL	250	6.50	1625
Kms = Distrance between Transport to OEM+			Grand Total	10540
Distance between OEM to Dealer			Total Miles	1550

FTL Rate/Mile = 7 USD and LTL Rate/Mile = 6.50 USD
Formula:
Dn = (Distance between Transporter to OEM + Distance between OEM to Dealer) * Rate/Mile (FTL/LTL)

5.2 Calculation (Daily Planned Schedule)

(In INR)

Based on Due-in Vehicles					
Dealer	Load Tp.	Kms	Rate / Kms	Total	
D1	FTL	100	15	1500	
D2	LTL	150	10	1500	
D4	LTL	120	10	1200	
D5	FTL	100	15	1500	
D6	FTL	150	15	2250	
D7	FTL	180	15	2700	
D8	LTL	250	10	2500	
Distance between OEM to Dealer				Grand Total	15150
				Total Kms	1250

FTL Rate/Km = Rs.15 and LTL Rate/Km = Rs.10
Formula:
Dn = (Distance between OEM to Dealer) * Rate/Km (FTL/LTL)

Based on Due-in Vehicles					
Dealer	Load Tp.	Kms	Rate / Mile	Total	
D1	FTL	100	7.00	700	
D2	LTL	150	6.50	975	
D4	LTL	120	6.50	780	
D5	FTL	100	7.00	700	
D6	FTL	150	7.00	1050	
D7	FTL	180	7.00	1260	
D8	LTL	250	6.50	1625	
Distance between OEM to Dealer				Grand Total	8490
				Total Mile	1250

FTL Rate/Mile = 7 USD and LTL Rate/Mile = 6.50 USD
Formula:
Dn = (Distance between OEM to Dealer) * Rate/Mile (FTL/LTL)

6. Benefits

(In INR)

Saving	Daily	Montly	Yearly
Cost (Rs.)	5000	100,000	1,200,000
Distance (Kms)	300	6,000	72,000
Diesel (L)	38	750	9,000

Cost Saving (In INR)

Total Cost Total Cost
(Daily Planned Schedule)

Daily Saving = 20150 15150 = Rs.5000 (Avg.)
Monthly Saving = 5000 * 20 (Working Days) = Rs.100,000
Yearly Saving = 100000 * 12 (Months) = Rs.1,200,000

Addressing Green SCM

a) Distance Saved (Kms)

Total Distance Total Distance
(Daily Planned Schedule)

Daily Saving = 1550 1250 = 300 Kms (Avg)
Monthly Saving = 300 * 20 (Working Days) = 6000 Kms
Yearly Saving = 6000 * 12 (Months) = 72000 Kms

(In USD)

Saving	Daily	Montly	Yearly
Cost (Rs.)	2050	41,000	492,000
Distance (Kms)	300	6,000	72,000
Diesel (L)	38	750	9,000

Cost Saving (In US \$)

Total Cost Total Cost
(Daily Planned Schedule)

Daily Saving = 10540 8490 = 2050 USD (Avg.) Monthly Saving = 2050 * 20 (Working Days) = 41,000 USD Yearly Saving = 41000 * 12 (Months) = 492,000 USD

Addressing Green SCM

b) Diesel (L)

In an ideal situation a vehicle (truck) gives an average of 8 kms/l, so considering the same on an average, the following should be the savings in diesel

Daily Saving = 300(Kms)/8Km/L = 38 L
Monthly Saving = 38(L) * 20 (Working Days) = 750 L
Yearly Saving = 750(L) * 12 (Months) = 9000 L

7. Conclusion

A green strategy provides prudent business processes. Successful green supply chain will feature cross functional collaboration, emphasize innovation, and stay tune to the strategic focus of supply chain and enterprise as a whole. Such a framework emphasizes network redesign, packaging changes, and business collaboration that promote a smaller carbon footprint and generates cost saving. The most strategic way is also the most fundamental - improves supply chain visibility and tactical knowledge, to help close the gap between the time you learn about something with significant impact and when you can actually do something about it.

Unlike other trends that become fads, adopting a green strategy provides long-term benefits.

The green movement may seem daunting to many companies, but more resources are becoming available every day. While the challenges may change, the fundamentals of good business remain the same.

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