Chapter 2: Logistics Network

Objectives

- Understand what logistics network is.
- Examine the factors involved in designing a logistics network.
- Examine the factors in determining the location of facilities.
- Understand the factors in determining the optimal number of DCs.

1. Introduction

Logistics network design is an important strategic decision that companies must make to ensure that required material are distributed efficiently from their suppliers to their manufacturing plants and warehouses, and the final products to their customers.

It is concerned with the determination of the location and number of warehouses and production plants, location and number of customer demand points to warehouses.

A logistics network design initiative typically covers three elements - the inbound and internal supply chain, outbound logistics, and reverse logistics.

2. Logistics Network

A logistics network is a system which is made up of a set of facilities linked by transportation services.

Facilities are sites where materials are processed, e.g. manufactured, stored, sorted, sold or consumed. They include manufacturing and assembly centres, warehouses, distribution centres, trans-shipment points, transportation terminals, retail outlets and others.

Logistics network design relates to the establishment of supply, warehousing and distribution infrastructure. It covers procurement, value-add and postponement activities and inventory control policies.

It seeks to minimize logistics cost while offering the right level of flexibility to meet service level requirements.

3. Designing a Logistics Network

Essentially, there are two major steps in designing a logistics network. These are:

3.1 Key Issues

- Pick the optimal number, location, and size of warehouses and plants.
  - How many DC, where they are located and their sizes?

- Determine optimal sourcing strategy.
  - How are supplies delivered? Rail, road, air or water?

- Which plant/vendor should produce which product?
  - Which plant should produce a type of a few types or complete FG?

- Determine best distribution channels.
  - How should the FG be delivered to retail or end user?

- Which warehouses should service which customers?
  - How should DC be located + size and which cluster of customers should they serve?

3.2 Information Requirements

- Customer service levels.
  - Some customers prefer 24/7, some within 2 hours, some the day after etc.

- Listing of all possible products to be handled.
  - Identify the types of products so that processes + MHE + picking method may be determined at the beginning.

- Location of suppliers, field warehouses, 3PL and customers.
  - Identify the sourcing points, stocking points and customer points to work out costs (inventory and transportation).

- Stock movement of inventory points.
  - Compute the inventory turns to establish ageing stocks and stocking levels.

- Transport rates.
  - Establish transport rates for various volumes according to transport modes.

- DC costs.
  - Establish the cost of operating DC – FC and VC.

- Order processing costs.
  - Establish the average cost of processing an order.

- Order patterns.
  - Establish how each customer's demands to prevent stock out.

- Possible unit loads and other common packing sizes.

- Establish the common loads especially unit loads to maximize loading speed and shipping.

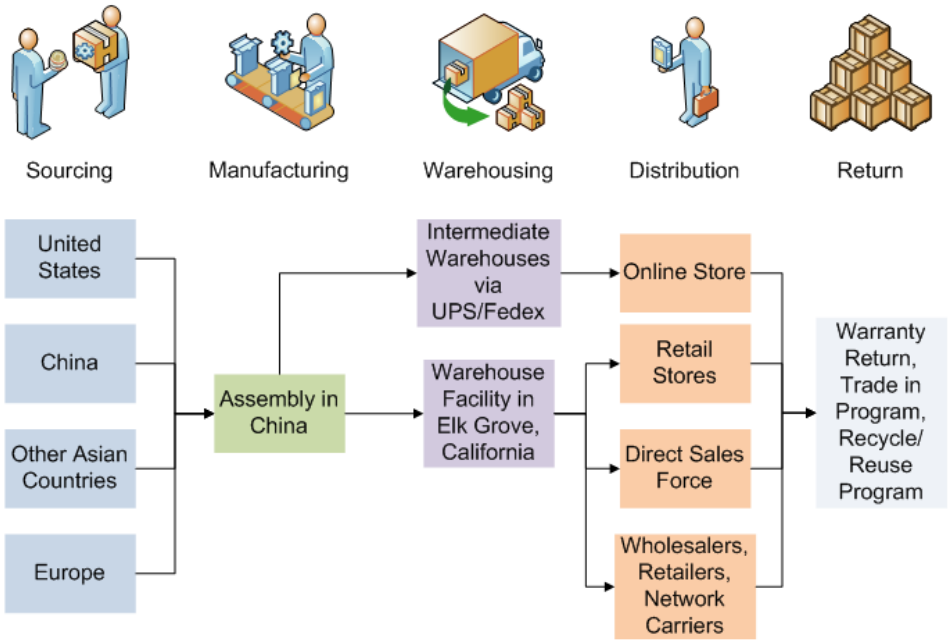

Figure 2-1: Logistics Network

4. Distribution Costs

Total distribution cost is a concept which seeks to secure optimum efficiency in the distribution process by choosing that total system of storage handling and transport which moves goods from the point of production to the point of consumption with the least total expense.

- Collection and storage of raw materials (often part of manufacturing cost).
- Collection and storage of components from sub-contractors (often part of manufacturing cost).
- Finished goods storage at the factory.
- Dispatch center costs at the factory.
- Transport to the DC.
- DC handling and inventory costs.
- Inter-DC transfer costs.
- DC dispatch costs (often part of sales cost).
- DC to customer transport costs (often part of sales cost).

- Administration and documentation costs at each of the above cost centers.

Total Distribution Costs

- Total distribution costs are the aggregate of the following costs:
- In-plant movement and storage.
- Plant-to-DC transport.
- DC operating costs.
- DC inventory costs.
- DC-to customer costs.

5. Location

Facility location decisions must obviously be made when a logistics system is started from scratch.

They are also required as a consequence of variations in the demand pattern or spatial distribution, or following modifications of materials, energy or labour cost.

In particular, location decisions are often made when new products or services are launched, or outdated products are withdrawn from the market.

The selection of the site of the facility will be the final stage of a sequence of decisions which begins with the selection of an appropriate region, then involves the selection of an appropriate area in that region, etc.

For an international organization, it is possible to identify at least four stages in this locational choice process, as outlined in Table 2-1. Different factors will influence decisions at each of these levels, and these also are outlined.

Decision	
No 1	Regional Decision (Asia)
	Some factors influencing choice: - location of markets - location of suppliers - location of existing plants, offices, etc - transport costs - availability of resources - climate - management preferences - costs - labour etc - legislation
Decision	
No 2	Area Decision (S'pore)

	Some factors influencing choice: - location of markets in the region - location of suppliers in the region - resources availability - management preferences - availability of suitable site - costs/inducements/taxes - transportation/communications etc
Decision	
No 3	Community Decision (Clementi Park)
	Some factors influencing choice: - sites available - communications - costs - land, construction - availability of utilities - amenities - local taxes, rates - proximity to related organisations - accessibility to and by customers
Decision	
No 4	Site Decision
	Some factors influencing choice: - site characteristics - services available - environment impact - expansion potential - local transport and amenities - labour availability - accessibility to and by customers - visibility to customers

Table 2-1: Locational Choice

4.1 Location Decisions May Be Strategic or Tactical

Whereas facilities are purchased or built, location decisions involve sizeable investments. In this case, changing sites or equipment is unlikely in the short or medium term.

This may be true even if facilities are leased. On the other hand, if space and equipment are rented (e.g. from a 3PL) or operations are subcontracted, location decisions can be reversible in the medium term.

Locations of facilities are places where there are:

- Demand for goods.
- Potential pool of employees.

- Infrastructure such as transport network eg roads, trains and ports.
- Utilities eg water, electricity.
- Accessibility to resources eg raw materials.

4.2 Location decisions May Affect Demand

Facility location may affect the demand volume. For example, opening a new RDC may lead to the acquisition of customers who previously could not be served at a satisfactory level of service because they lived too far away.

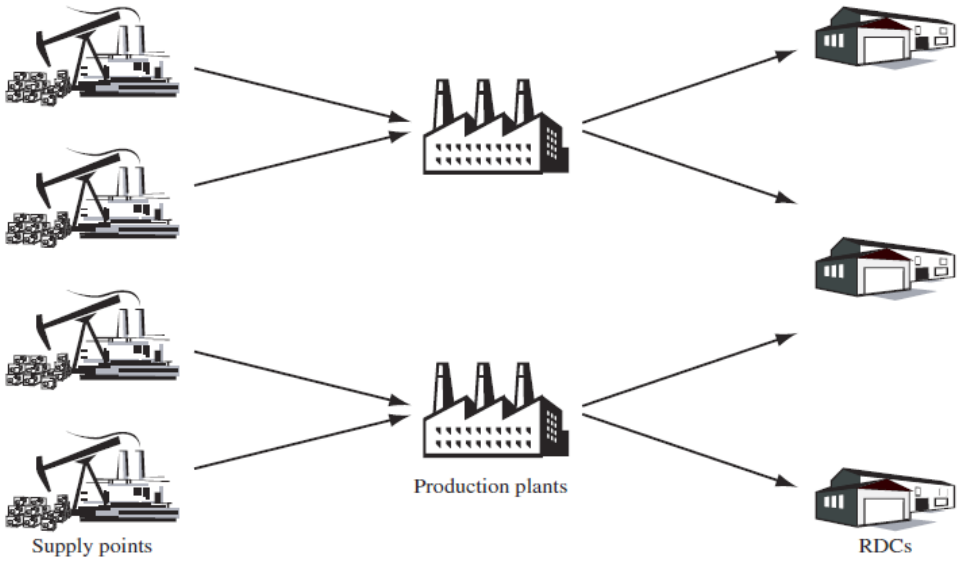

Figure 2-2: Multi-DC Network

Figure 2-2 illustrates the location of the DCs which have to take into account the volume and distance travelled by materials from suppliers to the factories and from the factories to the DCs and then from the DCs to the end users. These DCs have to consider the inbound and outbound volume and compute the cost associated with the individual DC locations.

6. Number of DCs

The factors to consider are:

- Cost trade-off
  - Inventory cost.
  - Warehousing cost.
  - Transportation cost.
  - Cost of lost sales.

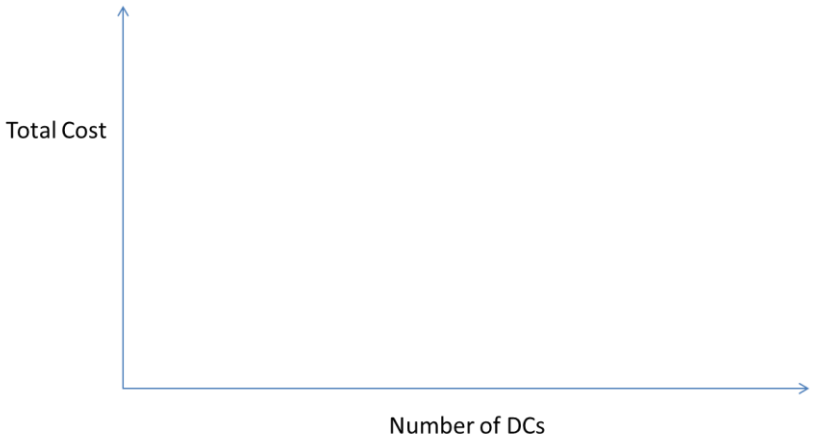

Figure 2-3: Optimal Number of DCs

7. Square Root Rule of Thumb

Before we end the chapter, we need to understand an important rule of thumb known as square root rule of thumb.

In simple terms, it means that when the number of facilities in a logistics network is reduced, the inventory is also reduced. The reduction is estimated to be based on square root.

As an example, if there are 16 warehouses and the number is reduced to 4, the reduction is square root of 16 which is 4 and square root of 4 which is 2.

The reduction in inventory is 50%.

8. Conclusion

We have covered the definition and design of logistics network which is a system which interconnect all the facilities via transportation. The network is also linked by the physical movement of inventory and information flow.

The next chapter will look at the beginning of the logistics network by reviewing the inbound of raw materials. This function is performed by Purchasing Department.