1

The Role of Warehousing and Stores

WAREHOUSING AND THE SUPPLY CHAIN

Warehousing is actively involved in the supply chain. In demand-driven supply chains this may be mainly by storing goods, or involve more sorting activities; both being required to largely feed external customers. In the supply-driven supply chains, then warehouses get renamed as stores, and hold stocks required to feed internal activities like production.

Warehouses are therefore an integral part of the supply/demand chain/pipeline infrastructure.

The term 'supply chain' is the process that integrates, coordinates and controls the movement of goods and materials from a supplier to a customer to the final consumer (Figure 1.1). The essential point with a supply chain is that it links all the activities between suppliers and customers to the consumer in a timely manner. Supply chains therefore involve the activities of buying/sourcing, making, moving and selling. Therefore, the supply chain 'takes care of business' following from the initial customer/consumer demand. Nothing happens with supply until there is an order; it is the order that drives the whole process. Indeed some people logically argue that the term 'supply chain' could be called the demand chain.

Additionally, as supply chain management is all about the flow of goods and information, then perhaps a better analogy than chain is a pipeline, as this better emphasises flow. Also to emphasise the flow aspects,

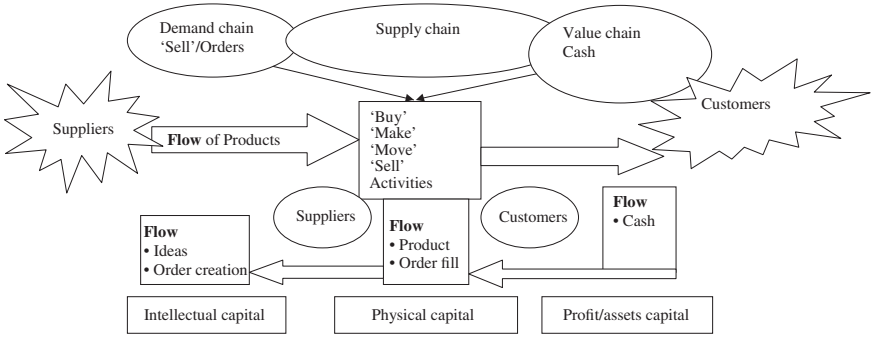

Figure 1.1 *The supply chain*

warehouses should perhaps be better thought of as undertaking sorting and not storing products.

It is also important to realise that each company has not one supply chain but many, as it deals with different suppliers and has different customers. For each finished product, while some of the buying, making, moving and selling processes will be identical or very similar, the total supply chain for each product will be different. Multiple supply chain management is therefore a better description but it is a cumbersome one. In supply chain management, therefore, there are many different supply chains to manage, with the varied goods being 'combined' in the warehouse.

CHALLENGE

How many supply chains exist in your company?

TRAINING TOPICS

Topic: Supply chains – Awareness of the key impacts and developments
Duration: 1 day

Course content

- ***Understanding what the supply chain is about***
  - Definitions: The interrelations and connections of buying, making, moving, and selling activities
  - History of the supply chain and its development
  - A view of the future.

- ***The key aspects***
  - The cost/service balance
  - Customer service principles
  - Lead times throughout the supply chain
  - Adding value
  - Production options/changes
  - Trade-off opportunities.

- **The benefits of adopting a supply chain approach**
  - The sub-functional conflicts
  - Benefits within functions
  - A supply chain view of total acquisition costs.

- **Why traditional ways are changed**
  - Demand amplifications and the 'Forester' effect
  - Uncertainty and unresponsiveness.

- **Impacts to the supplier/customer relationships**
  - Practical effects on lot sizes/order quantities
  - Reducing costs
  - Sharing developments
  - Eliminating internal and external barriers
  - Interfacing versus integrating relationships.

- **Supplier relationship case studies**
  - Manufacturing and retailer case studies
  - Lessons and key aspects from experience.

- **Implementing a supply chain management approach**
  - The changes needed
  - Potential action needed.

- **What happens if we do nothing?**
  - The 'do nothing' future of adversary relationships
  - Higher stock levels
  - Competition gains
  - Silo closed management approaches.

- **A 5-step approach to supply chain development**
  - The model ('should we?; benefits and drawbacks; internal issues; key issues; and finally')

DEFINITIONS

Definitions can be important to clarify thought and are especially so when one person understands a term to mean one thing but another person understands the same term to mean something different. This has been happening, for example, in the UK from the early 2000s with the word 'Logistics'. This term, which originally encompassed the whole supply chain, is now being referred to by many companies as a new name for transport, or for warehousing/stores or for distribution. Third-party transport companies are also beginning to call themselves supply chain management companies. Confusing, isn't it?

In the UK, one can observe the new name on a freight transport vehicle that was previously called 'Fred Smith Transport' and is now called 'Fred Smith Logistics'. Logistics can therefore be a confusing word and, additionally, some people use the term 'logistics' to describe their own internal company process, and use the supply chain term, when they are dealing with external suppliers/customers. At the risk of further confusion, others also call their internal logistics processes an internal supply chain!

Distribution is meant to be about delivering the right goods to the right place at the right time and at the right cost. This definition is the 'rights of distribution' and represents, in a simple way, the objectives for distribution. Distribution therefore involves the combining of transport with warehousing, and is a term that is often applied to finished goods. However, it may also be used by suppliers who are delivering product to their customers, perhaps of raw materials and semi-finished work-in-

progress goods. Suppliers are also concerned with getting the 'rights' correct and, as far as that supplier is concerned, the raw materials can, for them, be the finished goods.

Meanwhile, when readers hear the three terms 'logistics', 'supply chain' and 'distribution', they are strongly recommended to ensure that they have the full understanding of what the originator means when each term is being used. This can be very important and prevent confusions; for example, 'Fred Smith Logistics' is unlikely to have a clue about whether to outsource the manufacture of sub-assemblies or whether these can be manufactured internally. This would often be a strategic supply chain decision (but then again, some would say it is strategic logistics decision).

THINKING POINT

How are the terms 'logistics', 'supply chain' and 'distribution' used in your company and with the suppliers/customers with whom you deal?

With warehousing and stores, we can usefully define a warehouse as 'a planned space for the storage and handling of goods and materials'. It should not be 'a place where buyers keep their mistakes' – an observation from a major retail company in the early 1990s. Throughput and sorting are often of more importance than storing (especially in demand driven operations). The effective and efficient use of both time and the warehouse/site space are also important. The emphasis should therefore be on the planning of all the warehouse activities, including receiving, storing, assembling, kitting, picking and the despatching of customers'/users' orders. The warehouse is therefore able to consolidate, break bulk, cross-dock and provide value added services.

STRATEGIC ASPECTS OF WAREHOUSING

Warehouse management is often thought of as being just an operational day-to-day job. However, it should also be involved in the longer

strategic aspects of the business. Warehousing has a critical part to play in supply chain management and it can only play this part if it is involved in the strategic aspects of the business. This will involve being aware of the expected development of the business in terms of the future:

- production
- product
- suppliers
- customers
- and all the associated product volumes and throughputs.

Strategic questions on warehousing

- Do you need a warehouse?
- Is it in the right place for the supply/demand balance, transport, labour, and all other services needed?
- Are all the future supply and demand requirements known?
- Is the labour force stable?
- Is absenteeism above the national average?
- Are communications good?
- Is accuracy 100%?
- What is the real time visibility of information for inventory, productivity, cost and service?
- What is the shortest response time for customer orders?
- What are the levels of productivity and how do we know they are 'world class'?
- When did you last plan an ideal 'layout'?

By answering these questions, warehouse management is able to proactively assess situations and make important contributions to the decision-making process.

THINKING POINT

Who takes such a strategic view of warehousing for your company?

CUSTOMERS

We have mentioned earlier the importance of the customer order, as it is only the order from the customer that triggers all the activity in the supply chain, logistics or distribution processes. Without a customer order, none of these process or activities is required. The customer may be interested in buying products, but is really more interested in buying delivered products. Additionally, the time scale from ordering to receiving the delivery has in recent years often been shortened. A normal expectation in the UK, for example, is for next day delivery with many products, with some suppliers (for example, of stationery) offering the same day delivery to major national locations for orders received before noon.

This clearly puts pressure on the warehouse pick/pack/despatch operations, as well as on the transport operations, but it also shows a response to market requirements/expectations and one that offers a competitive advantage to the first company to deliver such a service.

Customer service levels are therefore variable and each customer service variable (such as same day delivery) has an associated cost. The relationship between cost and service is rarely a straight line, but is more of an exponential curve. So, a 10% increase in service may mean a cost increase of 15 or over 50%.

Customer value

Customers will place a value of many aspects of the total service offering. Value is also placed by customers against quality, the cycle lead time and the cost and the service levels. As perception is reality, customers can see these as being interrelated or may view them independently. It is therefore important for a business to understand the specific reality as seen by the customer.

The following are the aspects of the four customer value criteria:

1. Quality is 'performing right first time every time' and involves:
   - meeting requirements
   - fitness for purpose
   - minimum variance

- elimination of waste
- continuous improvement culture.

2. Service, is about 'continually meeting customer needs as the market changes', and involves:
   - support available
   - product availability
   - flexibility
   - reliability
   - consistency.

3. Cost, is about knowing what the costs really are and then looking at how to reduce them. This involves the:
   - design of product
   - manufacturing process
   - distribution process
   - administration process
   - stock levels.

4. Cycle lead time is about knowing what the lead times really are and then looking for ways to reduce them. This involves considering:
   - time to market
   - time from order placement to time available with the customer
   - response to market forces
   - days of stock cover.

A business, therefore, ideally will try to improve its quality and service, while reducing cost and lead times. All of the aspects are interrelated and connected and, for example, it doesn't matter to the majority of customers whether the goods are transported by road, rail, sea, air or multimodal or intermodal means, or whether they are stored, kitted or cross-docked in warehouses. The four factors above are what they really value. The method of distribution is purely a means to these ends and outcomes.

CHALLENGE

Find out how your customers rate the above quality, service, cost and lead-time factors

THE VALUE CHAIN

Michael Porter of Harvard Business School in his book *Gaining Competitive Advantage* introduced this concept in 1985. From Figure 1.2 you will see that this has significant implications for logistics/supply chain/distribution.

The value chain divides into primary and support activities as follows:

- Primary activities
  - Inbound logistics covering stores, warehousing, handling and stock control.
  - Operations covering production and packing and all activities that transfer inputs into outputs.
  - Outbound logistics include transport and warehouse networks to get products to customers.
  - Marketing and sales cover the methods by which customers know about and purchase products.
  - Service includes the support for all activities such as installation or returns.

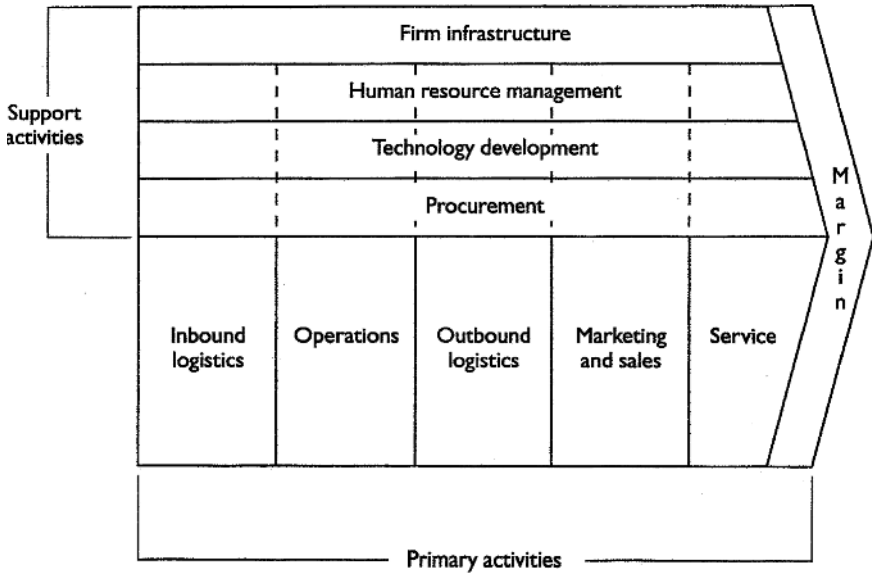

Figure 1.2 *The value chain*

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- Support activities
  - Procurement includes the buying and purchasing of products as well as all other resources.
  - Technology covers such items as information and communications technology (ICT) and research and development (R&D).
  - Human resource management covers all aspects concerned with personnel.
  - Infrastructure covers finance, legal and other general management activities.

Porter then expanded this concept of a value chain into a *value system*. This consists of a series of linked value chains. By this joining together of value chains into a value system, in effect we create a supply chain. Where the value actually is, according to Porter, is dependent on the way a customer uses the product and not just totally on the costs incurred in buying, making and moving it. These costs, including all the raw materials and activities that create the product, then represent its value. But it is only when the product is purchased that this value can be measured; and, finally, it is not until the product reaches the final customer/consumer that the real value is to be found.

Part of the difficulty here is that each individual organisation in the supply chain will attempt to define value by looking only at its own profitability. Each company will in turn carry on this definition to their suppliers and as the definition of value moves back up the chain, it will become distorted. Indeed, one of the reasons for companies to try to work together more closely with suppliers and customers is to have a constant view of value throughout the supply/value chain.

Therefore, we have seen that costs are added during the buying, making and moving activities and that ultimate/real value is only found when the product is with the customer. Meanwhile, value has been added by improving the product, by changing its form, moving it to a different place and all this has occurred over time. Therefore, we can see that value is added by:

- making it faster by changing the form
- moving it faster to the place required
- doing it faster by time changes

and that

- ultimate value comes after the movement to the customer.

Figure 1.3 shows how cost and value are added in the supply chain process.

Clearly, this diagram shows that goods being stored are incurring cost and are not adding value. Indeed, one challenging definition of a warehouse is that, in supply chain terms, a warehouse is an admission of defeat as we are planning to stop the flow of goods and materials and, therefore, are increasing cost and not adding value. While it will generally be the case that stored goods will not increase in value, this may apply to a very limited range of products, such as with bullion in non-inflation times and with works of art. The diagram, however, emphasises that movement to the customer as quickly as possible while accounting for associated cost levels is what really counts in adding value.

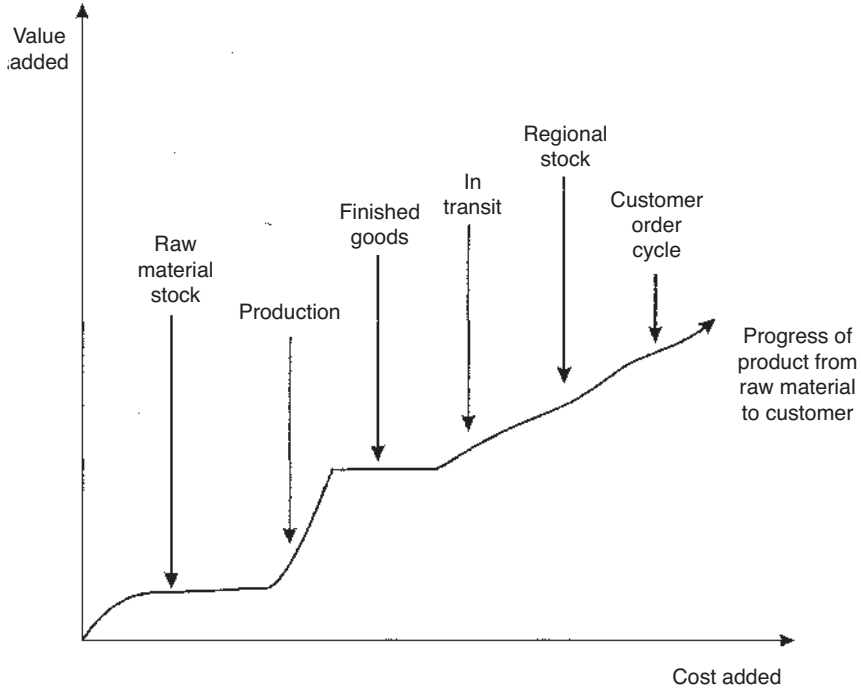

Figure 1.3 *Cost and value adders in the supply chain*
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THINKING POINT

How can you add value to your company's customer offering?

WAREHOUSE LOCATION

The location of the warehouse(s) can be a critical decision. Clearly for a business that is involved in manufacturing, its raw materials stores are likely to be the production sites, and the stores location is therefore determined by the location variables of the production sites. However, this is not an absolute and, for example, the Nissan car factory based at Washington, Tyne and Wear, holds little raw material stock on site as it follows a synchronised just in time (JIT) system with its suppliers (mainly located in the West Midlands), so that raw materials are received and the line is fed immediately.

The following represents the reasons why it may be necessary to move a warehouse:

- Financial savings: for example, from government grants. Hopefully this involves full trade-off decision-making, including for example any impacts to customer service levels and resultant financial implications.
- Cost savings: for example, by being closer to customers and saving in transport costs.
- Expansion: for example, the need to hold more product lines due to entries into new markets.
- Consolidating: for example, the closing down of regional centres or the consolidation of separate local sites into one location.
- Improve performance: old buildings may be difficult to convert to allow the use of more modern, up-to-date activities and systems.
- Facilitate change in operations or organization: for example, to conduct added value activities.
- Communications: for example, incorporating all of a company's business activities on the one site.
- Image: for example, to a 'showcase' site.
- Expiry of current lease.

In making the move, the following need to be considered:

- Impact to workforce: for example, potential redundancies of existing staff and recruitment of new staff.
- Recruitment opportunities: for example, availability with the possible attendant need for medium-term training.
- Proximity to the transport network: for example, locations in Northamptonshire and Leicestershire are popular warehouse areas due to the M1/M6/M69 and A1/A14 intersection road network and their central location with the UK population; that is, the source location of demand/where people live who buy things.
- Availability of social, recreational and cultural amenities: for example, a 'new town' may not have a source of supply.
- Housing for staff and personnel.
- Tax breaks: for example, when buying new assets.
- Real estate values: for example, regional variations are high, with London Heathrow being the most expensive.
- Neighbouring property development: for example, compatibility.
- Environmental impacts: for example, planning permission may not allow high rise structures.
- Local authorities: for example, warehouses are frowned upon in some areas as they are seen to take up a high amount of land for proportionally low employment.
- Customer perception: for example, how will they see the change?
- Customer reactions: for example, will they be concerned about service disruptions?
- Disruption to service: for example, coordinating with the supply/inbound stock to the existing location and the stock build-up in the new location before going 'live'.

When moving, surveys reveal that employees' preferences are in the following ranked order:

- near to public transport
- a safe area
- near to shops
- pleasant surroundings
- close to cafés, pubs and restaurants.

Meanwhile the employers' preferences, in ranked order, were:

- the quality of the workforce
- the access to road networks
- low overhead costs
- quality of the local environment
- local economic conditions
- competitive wage levels.

MODERN WAREHOUSE OPERATIONS

The supply chain: Temperature-controlled distribution

To illustrate the nature of modern warehouse operations in the supply chain, we look in this chapter at a specific operation of handling temperature-controlled food items. These are products that everyone in the UK will use, but the majority of people will understandably have no idea of what happens to ensure that quality is maintained. It will illustrate some of the detailed aspects of what is involved in warehousing.

Deterioration and climate

The aim of temperature-controlled distribution may be described as to create a micro controlled climate within the total supply/distribution chain. The object of this controlled climate is to prevent deterioration of the commodities being handled.

Commodities deteriorate more quickly in hotter and humid climates. Consequently the total design of the temperature-controlled distribution system needs to be undertaken carefully, and then run and controlled strictly.

System design

Important factors to consider in the design and operation of a temperature-controlled distribution system for food commodities are summarised below:

- Climatic hazards
  - Humidity
  - Temperature
  - Rain
  - Light (ultra violet)
- Biological hazards
  - Insects/mites/rodents/birds
  - Moulds
  - Bacteria
- Product composition
- Mechanical hazards
  - Handling process
  - Transport process
  - Sampling process
- Other hazards
  - Design of vehicles/warehouses
  - Pilferage
  - Working practices

If the system is to maintain product hygiene durability, then the reliability of operations (on mechanical and other hazards) and the reliability of control over climatic and biological hazards are of paramount importance.

Types of temperature control

Various types of temperature control are needed and these may be summarised as shown in Table 1.1.

A temperature-controlled distribution system therefore operates in a wide range of controlled conditions. The technical 'hardware' and the management 'software' needed to maintain such 'internal' conditions within a varying range of 'external' ambient temperatures will be explored further.

Cool/cold storage (−1 to +15 °C)

This temperature band prevents the rapid spoilage that is found when products are handled under ambient temperature conditions. While

Table 1.1 Types of temperature control

Type	Temperature	Product examples
Frozen	−30° to −10 °C	Meat, fish
Chilled	−5° to 0 °C	Fresh meat, fish, poultry
Cool	−1° to 5 °C	Dairy produce
Cold	5° to +15 °C below ambient	Citrus produce

microbiological spoilage is not completely prevented, the respiration rates in fresh fruit and vegetables are considerably reduced. Biochemical changes are therefore slowed down and the storage life is increased. For these reasons, preserved foods also benefit from cool or cold storage. For example, the storage life of canned foods can be doubled; dried foods can be stored 4–6 times longer.

When storing and handling food, it is necessary to specify the optimum conditions of temperature and the relative humidity. The optimum relative humidity arrived at is often a trade-off between the conditions that cause excessive drying and those that favour the development of micro-organisms.

Chilled/frozen storage (−30 to 0 °C)

In general terms, fresh foods of high moisture content have a freezing point 0 to 5 °C. However, with certain foods such as milk powders and some dry foods, the moisture content will not freeze. During the freezing process, ice crystals are formed within the food. This may have damaging effects on its texture and appearance and, to this extent, it is therefore possible to forecast the effect of subzero storage temperatures by considering the freezing point of the particular foodstuff. However, the rate at which heat is removed during freezing also affects the extent of possible damage.

While chilled storage does not provide indefinite protection against microbial spoilage, it does give a degree of rigidity to, say, animal carcasses, which aids handling and avoids tissue disruption.

With frozen storage, food materials may dry out unless protected by packaging. Drying in the frozen state causes a porous 'corky' appearance.

This condition, known as 'freezer burn', is caused when food is stored very close to the cooling surfaces.

Storage conditions

Temperature-controlled vehicles and warehouses are both very expensive to build and maintain. The cost of building a cold store, for example, is about three times that of an ambient store. Additionally, the storage temperatures required considerably affect the running costs of the distribution system. These running costs need to be balanced against the need to preserve the product.

Handling conditions

It is critical upon first receiving products into the system, to establish fully the required storage conditions under which the product is to be handled.

Next, it is critical to establish the match of the 'required' condition with the current condition of the product. The highest possible standards of quality control are needed. This is done by visual checking and by test probing and/or sampling the condition of the goods. Where a mismatch occurs, appropriate remedial action will be needed and must be fully documented. At each step within a distribution system, matching the condition between the actual and required states is a necessary and a critical job function. For example, reliance on the fridge vehicle to pull down temperature in transit is a hazard to avoid.

A product being stored needs to be handled in such a way as to ensure that adequate air circulation occurs around the product. Accordingly, product stacking methods and procedures need to be identified and followed.

Monitoring of the temperature conditions during storage and transport-ation need to be undertaken at regular intervals. This monitoring becomes especially important during the transportation as products are typically in the care of one individual – the vehicle driver. The driver needs to regularly monitor and undertake remedial manual defrosting and frosting as required. Within the very narrow temperature bands for chilled and cold cargos, this is not a task that can be easily dismissed.

Condensation damage

When goods are exchanged between low temperature and ambient conditions, it is probable that condensation will form on the exposed surface. For example, vehicle loading of frozen or chilled loads, in ambient conditions, can cause condensation to form on the product. Four courses of action are possible to prevent excessive condensation:

1. Ensure that distribution from the refrigerated storage is in small lots for immediate consumption.
2. Provide a series of 'tempering chambers' in which goods can be brought back to ambient temperatures in stages under conditions of low relative humidity.
3. Arrange immediate protection by moisture-proof covers.
4. Ensure that the removal from cold stores occurs at night when ambient temperatures are low.

The best course of action will depend upon actual circumstances and the specific requirements involved.

Service levels

As varying types of products are often handled in a temperature-controlled distribution system, these products will probably require varying rates of delivery into retail outlets. These varying delivery rates are due to the mix of service levels required, according to the product life cycle. For example, the requirements given in Table 1.2 may hold. Goods with a short shelf life may be moved in and out of a chill store in hours, whereas with a frozen store, the time scale may be weeks or years. The chilled and cold products are the most critical and, therefore, require stricter operational controls.

To illustrate some of the above aspects in practice, the following example of frozen food will be used.

Table 1.2 Service levels

Type	Examples	Typical deliveries
Frozen	Meat	2/3 times a week; 48-hour order cycle
Chilled	Fresh meat	Daily/3 times a week; 24/48-hour order cycle
Cold/cool	Dairy produce, Citrus produce	2/3 times a week; 48-hour order cycle

CASE STUDY 1.1: FOOD FREEZE PLC

The Company

Food Freeze plc (FF) are a UK based frozen food manufacturer/packer and have a major share of the European frozen food market dealing with all major and minor retailers and wholesalers. Whilst new product development is an important part of their business, they are relatively stabilised with around a constant of 500 SKU's at any one time.

They have three factories based in the East Anglia/Lincolnshire agricultural producing areas with another factory based in the Northwest in a former re-development area.

Distribution

The following flows of goods and materials are involved:

- Raw materials (such as packaging and ingredients) into the factories
- Finished goods from the factories to customers (either as full trailer pallet loads or as single pallets of one SKU).

FF deliver to customers on average 120 000 pallets per month but as a result of seasonality, the range is from a low of 90 000 to a high of 180 000 pallets per month.

Problems

Delivering direct from different factories to the same major retailers forced an examination of the physical distribution network.

Solution

A National Distribution Centre (NDC) was located in the Midlands, effectively a 'factory product mixer'. This meant that products from each factory could be combined into one customer load.

All finished goods are moved from each factory to the NDC for storage/re-sorting and because of the throughput and not storage nature of the product, a holding/storage capacity of one week's stock, in peak (45 000 pallets) was planned for.

The NDC was fitted with automated unloading/loading docks to connect with the automated loading roller bed floor equipment in the transport trailers. Once on the dock, a loading/unloading time of less than three minutes per trailer is achieved; product is then moved into the automated high bay warehouse.

Linked with the NDC is a dedicated core transport fleet of 30 tractors and 60 trailers, these being supplemented when required. The transport operations are co-ordinated closely with customer orders, and the collection of raw material supplies.

Both NDC and transport operations were outsourced to a third-party contractor on a cost plus open book arrangement.

Results and key aspects

- Customer order lead time fell from 4 days to 1/2 days
- On time in full delivery to customers (OTIF) increased from 83% to 97%
- Raw material delivery costs were reduced
- FF only need a very small core central team of supply chain planners, stock control and QC staff. The 3PL undertake the day-to-day order management, replenishment and delivery (based at the NDC), with additional 3PL planners based in the factories to liaise on production raw materials/finished goods availability.

- Communication is enabled by one daily conference call planning meeting and regular fixed weekly, monthly and quarterly meetings to discuss and review and improve operations.
- The cost plus contract arrangement gives cost transparency. Back-load savings are shared 50/50.
- Relatively paper free operations with EDI customer orders into the FF SAP system. This then links to the 3PL WMS and Transport systems.
- Each point where goods are transferred has automated temperature readings and the transport trailers are fitted with GPS equipment for traceability and control purposes
- Transport fleet is well utilised, for example, full trailer from NDC to a retailer RDC, from that retailer's RDC to a store of the retailers that is located near to a raw material/ingredient supplier, collection from there to a factory, and then finally from the factory and return to the NDC
- Demonstrates complete transport and warehouse integration with the FF activities of buying/purchasing and selling/customer demand.

WORLD-CLASS WAREHOUSING

The following are the basic points to which everyone involved in managing warehouse must be alert. Unfortunately, many of these basics do often seem to get lost in the search for new technology, in implementing new ERP systems or in embracing e-commerce. These potential 'new flavours of the month' can divert from and override the 'basics'; for example, if the writer had £10 for every time he has been asked 'How can I get a computer package that will do all the basic detail for me?' then, he would be a rich man.

1. *Do you need each warehouse?*

Networks can grow without examination and looking at them overall in terms of a supply chain is needed. Inventory levels will generally grow as

more warehouses are added. This topic has already been partly examined above.

2. *How can each item be packed?*

Product-handling groups are useful to show and to determine package sizes. The issue pack needs to account for marketing concerns; customer order policies, inventory levels, and operational activities.

3. *What products should be kept?*

The common problem is keeping too much stock (the warehouse may be a place where buyers are keeping their mistakes). An ABC Analysis can be very revealing and help to determine which SKUs should be carried. It can then be determined how they flow through the supply chain; for example, some can bypass, and some can be cross-docked. These above two topics are covered in Chapters 2 and 3.

4. *How many times do you handle products?*

Reducing handling increases productivity and lowers costs. It should be noted that handling twice only occurs for direct delivery from supplier to customers. Putting product into store and picking from store will generally be handled from supplier to customers, 12 times.

5. *Do you store products in relation to the flow/rate of movement?*

Not all products have the same demand. An ABC Analysis will show which products have fast/medium/slow movement, and help to better organise operations to minimise the time and the distance travelled in the warehouse.

6. *Do you know exactly where each product is located?*

Zoning in the warehouse will be needed.

Topics 4 to 6 above are covered in Chapters 4 and 5.

7. *Is the layout optimal?*

Organising the warehouse for flow works; however, things change and so a regular review of the layout is needed.

Warehouse layout is fully covered in Chapters 4 and 5 and Chapter 7 examines the regulation involved in warehouses, it being of no use for example, to have an optimal warehouse layout if, for example, it contravenes health and safety legislation.

8. *What are the operational standards?*

'You cannot manage it, unless you measure it.' Are the following included in the warehouse management?:

- Costs and utilisation of resources for each activity in the warehouse: for example, space and time.
- Performance of activities: for example, receipts and picking rates.
- Accuracy of activities: for example, full complete orders despatched.
- Lead times for activities: for example, time from receipt of order to time ready for despatch.
- Safety: for example, accidents.
- Morale and motivation: for example, absence levels.

Chapter 8 looks fully at these issues, with Chapter 6 looking at how standards may be recorded with ICT.

9. *Should you outsource or manage warehouses yourself?*

Assuming you know which warehouses are needed, the next step is to decide how they are operated. Some questions to ask are:

- Is warehousing a core competency?
- Can third parties be more efficient?
- What will be customers' reactions?

Chapter 9 examines this outsourcing topic.

10. *Do you have a multiskilled work force?*

Rarely are activities flat, but peaks and troughs are normal. Being able to move people between activities in the warehouse, or between warehouses in a network, will help to flatten out the peaks/troughs. Managing people correctly is critical, and is examined in Chapter 10.

CONCLUSION

Warehousing clearly has a critical part to play in all aspects of supply chain management. It also needs to be involved in the strategic aspects of a business and this will involve being aware of the development of the business in terms of the future production, product, suppliers, customers and all the associated product volumes and throughputs.