Supply Chains and Logistics Services

Key Themes

- What role do service businesses play in global supply chains?
- Supply chain management
- Logistics
- Radio frequency identification (RFID) and supply chain management
- IT and logistics
- Value chains
- Just-in-time and lean

No market economy can operate without a complex and extensive service economy that supports flows of people, money, raw materials, components, customers and completed products and service delivery systems. Thus, no business functions in a vacuum as it must be integrated into a set of inter-organizational relationships facilitating innovation, development, manufacturing and the co-creation of services. A key element within this network of inter-organizational relationships is logistics, or the industry that has been developed to transport and manage inputs that flow between places and across space. All firms need to bring together a set of inputs that vary by type of business and also must focus on organizing and distributing flows of inputs and outputs in a timely and cost-effective fashion. This includes just-in-time supply systems, but also operational models that involve delivering services remotely through platform-based systems. This includes on-line platforms, for example, Zoom and Skype, that played an important role during lockdown introduced in response to the Covid-19 pandemic. Raw materials and semi-manufactured articles must be brought to the next step in the manufacturing process and finished goods must be brought to retailers and then to final consumers. Information, including big data, knowledge and money must flow to support all types of transactions.

In 2005, Adam Minter, a journalist, visited Yantian, a district of Shenzhen, and the location of the Yantian International Container Terminals or YITC. This was China’s second largest port and the fourth largest in the world. YITC exports most of the goods manufactured in the Pearl River Delta, otherwise known as the Workshop of the World. YITC is a deep-water port with 16 berths for ships and covers 373 ha. During Minter’s visit, he was informed that $147 billion in goods had moved through this port over the last 12 months involving more than 13 million containers. Only 10% of these containers held imported goods and 90% carried exportable goods. This 90/10 split reflects the trade imbalance between China and the rest of the world. YITC, like all major ports, plays an important role in international logistics.

There is another side to YITC, and this involves the return of empty containers from their

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destinations back to China. Containers can be shipped empty, but this involves cost rather than profit. The alternative is for shipping companies to discount shipping rates for containers returning to China. Minter noted that ‘In early summer 2012, for example, the price of shipping a 40,000-pound container from Los Angeles to Yantian was a paltry $600. Going from Yantian to Los Angeles, however, could cost four times as much’ (2013, p. 86). High-volume relatively low value goods are transported in these containers from the US to China. In 2013, this good was scrap metal—copper, aluminium, lead, zinc and electronics for recycling.

YITC is one element in the network of international infrastructure that forms an essential part of the international supply chains that link Guangdong province with the rest of the world. This type of infrastructure highlights the complexity of the infrastructure networks that lie behind logistics and supply chains.

This chapter explores an important service function and related industry. In Chap. 12, the focus is on the servitization of manufacturing or the role that production- and product-related services play in manufacturing industries. It is important to appreciate that the on-going development of product-orientated global value chains (GVC), or global production networks (GPN) is facilitated and enabled by innovations in the provision of logistics services. Thus, logistics services are one of the catalysts behind internationalization. Reading service business involves understanding the ways in which logistics services and supply chain management support outsourcing, offshoring and inter- and intra-firm movements of all types. This includes the services that support flows of raw materials, components, completed goods, people, expertise and information and finance that are the focus of this chapter.

11.1 Development of Logistics Services

The development of the industrial revolution is associated with innovations in agriculture, manufacturing production systems, finance and logistics. Logistics played a critical role in facilitating trade and travel. During the nineteenth century, the United Kingdom’s ‘market economy become more sophisticated and complex, and more and more resources had to be invested in those activities that reduced transaction costs in the economy’ (Mokyr 2009, p. 250). This reduction in transaction costs was extremely complex and transformed national economies through infrastructure investment. In Mokyr’s analysis of Britain and the industrial revolution he argued that:

Of the many “revolutions” that were supposed to have taken place in Britain between 1700 and 1850, the transportation revolution occupies a pivotal role, in that it affected all other sectors in subtle but pervasive ways, and was itself subject to the institutional and technological advances that changed the British economy. (Mokyr 2009, p. 202)

Transport facilitates innovation across national economies but is also continually subjected to innovation. There are three key innovations that need to be highlighted.

First, there was an increase in the knowledge or the expertise intensity of firms. The origins of this shift towards knowledge-led production systems can be traced back to the early origins of capitalism. This led to a growth in professional service occupations involved in developing and providing knowledge inputs to firms. It led to a renaissance in universities with the establishment of new universities intended to provide skilled labour, but also research that would contribute to local and national economic growth. Between 1700 and 1850 the market for information of all kinds expanded dramatically. Part of this expansion included an increase in the number of specialists involved in information and knowledge distribution including teachers, lawyers and journalists and growth in economic activities that relied on accessing and translating information into knowledge, for example, merchants, speculators, financial analysts, insurance companies and merchant banks. Many of these specialists contributed to internationalization by providing the information, knowledge and expertise required to support the development of interna-
tional value chains facilitated by developments in logistics and affiliated infrastructure (financial services including insurance). During the nineteenth century, there was significant investment in the discipline of geography and also in cartography. Maps were needed for military and commercial purposes including transportation; geographers played a key role in identifying commercial opportunities based around natural resources.

Second, communications played a central role in capitalism’s on-going evolution. In England, major investments in the country’s road network can be traced back to the period AD43–AD81 with the construction of roads, bridges, fords, a river transport network and regular posting stations by the Romans. The Romans brought with them ‘the art of letter writing, an efficient postal system and the skills required for building paved roads’ (Beale 2005, p. 14). Developments in infrastructure preceded the creation of a national and then international postal service. For England, plans for a national postal service were developed in 1620 and in 1635 a royal proclamation was issued to establish a national postal service centred on London. Initially all letters were sent to London and then sent on to the final address. Prior to 1635, letter carrying was restricted to the monarchy, the Church, the towns, carriers, merchants and the nobility and gentry. From 1635, innovations included the introduction of local sorting offices and roads linking all towns to the main transport routes. From 1635, developments in the English postal service ‘assisted the development of trade and industry and brought great social benefits to the country’ (Beale 2005, p. 271).

Third, moving ideas, people, materials, completed goods and delivering services required major innovations and investment in communications and transportation networks. These networks became the backbone of the shift towards an international economy. Britain during the eighteenth century had a well-developed transportation system that included coastal shipping and privately constructed roads and canals. To Mokyr:

There is little doubt that this transport system helped in technological progress, not just in making the mobility of people and ideas cheaper and faster, but because more integrated markets multiplied the gains from innovation and because protecting more technologically backward “niches” would become increasingly difficult. (Mokyr 2009, p. 154)

Infrastructure facilitated the integration of local markets into the national and increasingly international economy. Complex infrastructure networks emerged for the transmission of ideas, money, people and goods and included machines for processing information. The shift away from local economies to economies that are multiscalar involving complex local, regional, national and international interrelationships is closely associated with developments in six inter related infrastructure networks: telegraph cables, broadcasting transmitters, telephone networks, satellites and global positioning systems, the Web and mobile telephony (Billing and Bryson 2019). The end result was that the globe became wrapped in millions of underground, over ground and beneath the sea, copper and fibre optic cables.

Transportation and communication infrastructure of all types contributes disproportionally to national economies and to internationalization. One reading of their impacts is the role they have played in time space compression or time space distantiation (Harvey 1990). This concept refers to technological and process innovations that alter the dimensions of time and space. Improvements in transportation systems reduce the time required to travel between places with the Internet enabling individuals to be simultaneously co-present in many locations. To Massey, technological innovation has resulted in an on-going process involving ‘speeding up’ and ‘spreading out’ (1994). These processes facilitate internationalization, but they are also an outcome of internationalization with many complex feedback loops.

Logistics services rely on a complex array of interwoven transportation and communication networks. Each network reflects the activities of a set of companies, institutions and regulators involved in the delivery of transport-enabled services involving the movement of something from
one location to another. These infrastructure networks involve ports, airports, river transport, maritime transport, air freight systems, roads and communication networks, including satellites that track flows of people, parts and goods and teleconferencing platforms. It also includes specialist logistics providers as well as warehouse operators. On-going developments in e-commerce continue to reshape the geography of retailing. Part of this reshaping shifts retailing from high streets to extremely large warehouses located in central locations and adjacent to key transportation routes. The application of just-in-time systems to manufacturing has altered supply chain logistics; a continual stream of lorries has replaced warehouses co-located with manufacturing plants.

This chapter focuses on exploring logistics services, the management and organization of supply chains and internationalization. These processes operate within GVC or GPN facilitating flows between places. Without these services it would be impossible for firms to develop and manage distributed or fragmented production systems. It is this infrastructure, and related services, that has made it possible for companies to develop GVCs/GPNs. Any disruptions to the infrastructure that supports logistics services, or to logistics processes, has major consequences.

Case: KFC and Supply Chain Failure

On 16 February 2018, Kentucky Fried Chicken or KFC, the American fast food restaurant chain that specializes in fried chicken, experienced a major logistics and supply chain failure resulting in the closure of over three quarters of its restaurants across the UK. The closure of these restaurants was the result of a single point-of-failure in the restaurant’s supply chain combined with a failure in contingency planning. This became a major media crisis for the firm resulting in reputational damage, but the event also impacted on the company’s profitability. This logistics and supply chain failure can be traced back to a decision made by KFC to replace its then current logistics partner.

On 14 February, DHL took over from the former logistics contract holder, Bidvest. One of the reasons behind this failure was the geography of warehouse provision. DHL operated from a single warehouse located in Rugby while Bidvest had supported the delivery of the KFC contract from six warehouses. At around 01.40 on 14 February 2018, a collision involving several vehicles occurred between junctions two and three of the M6 motorway. The motorway between these junctions was closed by the police. A second accident then occurred at junction 1 involving a collision between two lorries. These three motorway junctions were critical for DHL’s Rugby warehouse. Its lorries were unable to move, and this initial problem led to the failure to deliver to KFC’s UK restaurant network. It is common for logistics providers to operate from a single warehouse located in the ‘golden triangle’, the area between Milton Keynes, Rugby and Daventry. It is possible to deliver overnight from this area to most parts of the UK.

The supply problem began to impact on KFC operations on 16 February. The company began to close restaurants. By 18 February, 604 of the company’s 870 restaurants were closed across the UK. KFC restaurants located in Ireland, north and south, were unaffected as they had a different logistics system in place. This high-profile supply chain failure was complex. DHL was using a new warehouse with a new IT system. The road problems, the single site, the new warehouse, automation and supply chain management software combined with demand contributed to this supply chain failure.

There is another side to this failure. KFC’s UK supply chain includes over 500 farmers. This enables the firm to use fresh chicken. This supply chain failure led to a significant increase in waste with entire lorries of chicken having to be written off. Supply chain failure enhances waste and also undermines a company’s reputation. There is a responsible business aspect to this. Replacing one logistics provider with another to reduce costs perhaps makes business sense. But was this a responsible business decision? The answer would perhaps have been ‘yes’, if no customer had noticed this alteration in KFC’s logistics partner.
The KFC supply chain failure highlights the contribution that logistics and supply chain management make to business. It also emphasizes the importance of supply chain contingency planning. It is important to appreciate that competition between businesses is based on the effective functioning of all inter- and intra-company operations. A company like KFC competes on its brand, marketing, price, quality of food, a distinctive food offer, the nature of the service experience, staff recruitment and training, health and hygiene, but also on the effective co-ordination of logistics and the company’s supply chain. The KFC incident highlights that a supply chain involves collaborations between many different companies, equipment, information management systems, processes, staff and a country’s national infrastructure system and often international infrastructure—ports and airports. The co-ordination of company networks, and the interface with infrastructure networks, plays a central role in all economic transactions.

11.2 Supply Chain Management and Logistics: Definitions

Processes that involve the flow of goods and materials within production value chains are called supply chain (Hugos 2011). Wholesalers are, for example, part of a supply chain; a wholesaler represents one node within a supply chain for storing many components and goods produced by many firms. The organization and handling of a supply chain involves a process of supply chain management (Hugos 2011). This is a very complex service activity (Lusch 2011) undertaken by all types of companies—agricultural, mining and manufacturing—as well as specialist providers of logistics services.

As an example, consider the requirements of a small one-person business such as a roadside burger stall. To provide this service a suitably equipped, perhaps specially adapted, towable stall must be assembled. It may be possible to purchase one ‘off the peg’ but it is more likely that the necessary equipment will need to be procured from different suppliers before configuration and assembly, either by the stall’s owner or by a specialist fabricator. Then the raw materials required to produce goods must be acquired including meats, sauces, salad, peppers, vegan sausage rolls and so on as well as cooking oils. These inputs are purchased from various suppliers and require delivery either to the home of the stall owner or directly to the burger stall. Grease proof wrapping, plastic or paper plates, cups, knives and forks will be among the disposable and recyclable items that customers will expect to be available when purchasing from this stall. Potential customers will need to know about the existence of the burger stall; roadside signs will need to be commissioned and an Internet presence arranged. These are just some of the requirements that the owner of a burger stall must manage to create and deliver burgers into the hands of customers. This is a very simple example, but clearly what is required is the efficient coordination of each step or component in the burger stall’s supply chain that ultimately ensures that the stall can provide goods to consumers. This is what logistics is all about. Now imagine, that the burger stall is a large factory owned by Boeing or Airbus that produces commercial airliners. There is a major escalation in the number of components in the supply chain. It is critical that every component is available in the factory when it is required. Any supply interruptions may prevent completion and delivery of an aircraft to a client resulting in major costs.

Logistics is the process of handling and managing supply chains, including designing supply chains, ensuring that the flow of parts within a supply chain is efficient, reducing costs, increasing the perceived customer quality of the supply chain handling process, procuring, storing and transporting goods and raw materials. Effective and efficient logistics enhances the efficiency of production processes. Transportation within logistics systems is a major consumer of fossil fuels and a major polluter. A key challenge is to remove fossil fuels from supply chains and to reduce carbon emissions.

Logistics refers to all processes involved in storing, moving and transporting a good or delivering a service to end-users or to the transfer of
the upstream components of a supply chain to a service firm. According to the Council of Logistics Management (1998), logistics is defined as:

the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements.

This definition includes inbound, outbound, internal and external movements, and the return of materials for environmental purposes. While all service businesses will need to engage with supply chain management and logistics management, some will themselves be suppliers of logistics services. Thus, a Vice President of United Parcels Service (UPS) customer relations described their role as one that concerns ‘implementing efficiencies across a business’s entire supply chain that help them achieve their strategic goals’ (UPS 2016). Let us return to our simple example of the roadside burger stall.

A burger stall relies heavily on backward and forward linkages that combined form a supply chain. Backward linkages are defined as channels through which information, components, money and completed goods flow between a company and suppliers of intermediate inputs into the supply chain. This includes all the facilities and processes necessary for the procurement of raw materials (knowledge, information, office supplies) and the production of the service (equipment, office space, human resources). Forward linkages include investments in distribution networks that are intended to connect producers and/or suppliers with consumers. This includes mechanisms for delivery (transport, broadband, warehousing and banking services) to customers or transactions with creditors.

Supply chains transport goods from the first raw material (e.g. metal or agricultural products) to places, factories, warehouses, offices, that transform materials into goods (factories) and then completed goods are transported to wholesalers, retailers and to final consumers. The consumer might be a final or end-consumer or might be an intermediate consumer with an input being incorporated into another production process. The chain metaphor highlights that logistics operations move things between nodes or places, and these represent different links in a chain. Every link is important.

A supply chain is not a liner process. The chain metaphor is confusing as it simplifies a non-linear process into one that appears to be linear. Supply chains are non-linear; many inputs from many different locations come together at key production points in a supply chain. Companies must develop supply chain contingency plans. Such a plan would include the same part being supplied by different companies. It is important that a supply chain is not overly dependent on one primary supplier; any disruption to that supplier’s ability to provide intermediate inputs will result in an interruption of a company’s production process. Covid-19 has highlighted the importance of risk management within supply chains. An analysis of SARS and its impacts on supply chains noted that ‘supply-chain management and corporate strategy require a fundamental rethink to balance the pursuit of efficiency with increased responsiveness and flexibility’ (Tan and Enderwick 2006, p. 515). This includes diversification in sourcing and corporate strategy, a shift from linear to contingent-based planning and scenario-informed planning.

Supply chains not only transport goods, but also ensure that the right goods reach their destinations at the right time. Depending on the size of the service business it may be necessary to use supply chain management to oversee the interface between internal and external operations of the various components of a supply chain. This is to ensure efficient performance combined with cost control. This is even more obvious when it comes to large service firms that are heavily dependent on supply chains such as supermarkets and airline companies. These firms are unable to transact business without large, complex but efficient supply chains, which are able to handle substantial amounts of goods delivered at an exact time and to a specific place. Such service companies may specialize in providing food or transportation services to customers, but they are also companies that must specialize in the management of complex supply chains and logistics.
Logistics is not only about handling goods in and out of lorries and containers. Handling and transportation must be planned and managed. IT systems are a core means to do that, particularly in large logistics systems. The logistics functions must be staffed, and the goods stored in the right places. All is assigned to an economic law of cost efficiency and price competition, but with Covid-19 the emphasis must be on cost control combined with risk management. Significant amounts of money can be wasted or made just by making minor adjustments to a large logistics system.

11.3 Radio Frequency Identification, Logistics and the Management of Supply Chains

Manufacturers and retailers have introduced radio frequency identification (RFID) to track components and goods as they move through a supply chain. A RFID tag uses electromagnetic fields to automatically track and identify objects. The tags contain stored information. There are two types. A passive tag collects energy from an adjacent RFID reader’s radio waves, while an active tag contains a local power source. Passive tags must be located close to a RFID reader and active tags may be located much further away. Unlike barcodes, a RFID tag does not need to be within the line of sight of the reader. RFID tags are used in supply chains across different industries. That are used to track, for example, components that are part of automotive production lines and are also used to track pets and livestock. The application of RFIDs to a supply chain enables further streamlining of the supply chain and inventory optimization. Each item in a supply chain can be identified and tracked increasing enhanced inventory control and visibility. This enables the identification of items that are in the wrong location or have been stolen.

Logistics subsectors include transport at land, sea and in the air, and these transport forms may be interchangeable. It may be a matter of practical conditions, customer requirements for delivery times and conditions and price whether a good is sent by lorry, ship or aeroplane—or maybe even by bicycle or drone. Transportation providers, postal services and wholesalers are all part of the logistics industry and part of supply chains, but retailers and also cafes, restaurants and hotels are also part of supply chains. Information technology (IT) logistics planning systems are an important element in the management of logistics businesses. Some service firms specialize in the planning and management of logistics services rather than the direct provision of transportation services.

Logistics have risen in strategic importance (Potter and Mason 2015); from handling simple manual work tasks to the management of advanced IT and tracking systems. Supply chain management has become increasingly important for companies’ profits, production line planning and customer relationships; often it is logistics service firms’ employees that engage directly with customers representing the company. Logistics services have become a core part of the networked economy; often they are ‘the spider in the center of the network’, and therefore, play a central and often dominant role.

Amazon, which is the world’s most valuable company, is an example of a logistics company that started as a modest supplier of books, but which has developed into a business that dominates a large part of all commerce on the Internet. Amazon is a set of warehouses linked to a supply and logistics management system that is intended to enhance the movement of goods and services from suppliers to consumers. At the centre of this business model are logistics and the organization of efficient and automated warehouses or Amazon’s fulfilment centres. Amazon has built a very distinctive distribution network. Central to this is Amazon’s logistics division based in Seattle and the company’s supply-chain algorithm team. This team is:

Amazon’s secret weapon, devising mathematical answers to questions such as where and when to stock particular products within Amazon’s distribution network and how to most efficiently combine various items in a customer’s order in a single box. (Stone 2013, p. 164)
Amazon renamed its warehouses as fulfilment centres (FC) as their primary task was to fulfil customer orders. The challenge is that the exact combination of goods purchased by a customer might never be repeated. Algorithms have been developed that seamlessly match demand to the most appropriate fulfilment centre through a process that levels out backlogs to remove supply chain blockages.

Over time, Amazon’s fulfilment process has been transformed from:

a network of haphazardly constructed facilities into something that could more accurately be considered a system of polynomial equations. A customer might place an order for a half a dozen products, and the company’s software would quickly examine factors like the address of the customer, the location of the merchandise in the FCs, and the cutoff times for shipping at the various facilities around the country. Then it would take all those variables and calculate both the fastest and the least expensive way to ship the items. (Stone 2013, pp. 184–185)

Amazon’s logistics management systems are a core element of this on-line platform’s competitiveness. A key issue is a focus on ‘speeding up’ and ‘spreading out’ Amazon’s supply chain. The company refined its supply chain to reduce the cutoff time for next-day deliveries to within 45 min before the last truck leaves a FC. It also has continued to extend the company’s reach, or to colonize, adjacent retail sectors. Amazon is an extremely complex company. It has developed its own branded goods including fashion brands and continues to disrupt existing retail-orientated supply chains.

Pack or package delivery to households has always been a problem. It is expensive to manage and transport packages to many households. This type of supply chain involving the last mile or kilometre to the customer is time consuming involving capital equipment and employees. The task has traditionally been undertaken by state-owned postal services; many have been privatized and converted into providers of logistics services. Package deliveries have increased substantially with the substitution of high street retailing with e-commerce. Amazon’s business model is based on the efficient and low-cost delivery of packages to households. The growth in e-commerce has been the basis for new logistics service providers including in Germany, DHL, and in America, UPS. Their business models are based on the operation and management of fast and safe package delivery systems. They use IT systems, bar codes and global positioning satellites (GPS) to identify and track package and to plan delivery routes. Additional services have been developed enabling consumers to track packages within the supply chain. These logistics firms have grown rapidly to become large trans-local or transnational corporations.

11.4 Functions and Logistics Services

11.4.1 Supply Chain Management

Supply chain management incorporates several functions including managing supply and demand, logistics, purchasing, the service design interface, selling/sales system interface and defining business boundaries and relationships (Simchi-Levi et al. 2008; Hugos 2011). The latter is at the core of the design of all supply chain management initiatives; which aspect(s) of a service should be produced in-house, and which should rely on third party suppliers. This is sometimes referred to as outsourcing (cf. Chap. 8) and such decisions are made in the context of the importance of retaining proprietary knowledge relating to a service, information about the reliability and quality of third-party suppliers and the costs associated with using third-party suppliers relative to in-house provision. Logistics includes storing raw materials and goods between the time of production and transportation to retailers or customers.

A supply chain is often known as a value chain (Porter 1998; Sundbo 2011). The term value chain is predominantly used within service research as the term links customers with value creation—the service aspects of a value chain—that is emphasized in service theory (Lusch 2011, see also Chap. 2). The term supply chain is more associated with the management of logistics
related to the movement of goods between producers and consumers (Tortorella et al. 2017). In this chapter, the two terms are used synonymously.

Demand management, for example, is about ensuring that all stages in a supply chain to an end user of a service acquire the required inputs in the correct quantities, in the correct sequence and at the right time conforming to end-user expectations. Purchasing management is concerned with the supply side around activities such as stationery, IT services, printing, and advertising. The selling role within a supply chain ensures that service end-users are aware of availability, how it can meet the needs of clients, how to select it, how to buy and pay for it, and what is available by way of after-sale support and upgrades, where appropriate.

11.4.2 Food: A Critical Supply Chain

Everyday living involves purchasing and consuming food and drink. These decisions link every consumer to a complex and evolving network of supply chains. Provision of food is an example of a supply chain that may seem simple from a traditional point of view, but which has developed into a set of extremely complex processes linking consumers with farmers. A traditional food supply chain can be exemplified by the production of pork. This involves several distinct stages based around rearing animals and their incorporation into a production process that has within it a supply chain. During the late nineteenth century, Chicago’s meat-packing operations were one of the initial inspirations for the application of mass-production processes to the automotive industry, by Henry Ford. These disassembly lines led to the development of assembly lines that relied on the management of complex supply chains. Our meat example involves the following stages (Fig. 11.1).

This very simple linear supply chain has become increasingly complex. This complexity has been driven by enhanced global competition combined with the application of new technology. Meat supply chains have become less of a local industry and now involve the management of international supply chains. This complexity is illustrated in Fig. 11.2.

Farmers are no longer responsible for the complete process of rearing pigs. Part of this process has been transferred to other countries with lower rents and labour costs. Part of the slaughtering process has moved to other countries for the same reasons. Pork meat is not delivered directly from slaughterhouses to retail shops but is processed in factories and delivered to a supermarket chain’s central warehouse from which it is distributed to individual supermarkets. Factory processing has been introduced into this supply chain as consumers no longer want to handle large pieces of meat but want to purchase pre-sliced chops or complete dishes. Supermarket chains have central purchasing and storage systems that are used to manage the distribution of food to supermarkets. More firms are involved in this logistics process and this requires strict guidelines and monitoring of food handling, for example, hygiene, cooling and the management of a food product’s total time within a supply chain process. This has created a market for the formation of specialist logistics service firms that provide a total supply process or third-party logistics (see next section). Alternatively, fourth party logistics service firms have been established which specialize in selling knowledge about the management of logistics processes. Such an approach to total logistics requires the application of sophisticated information technology including algorithms and RFID sensors.

![Fig. 11.1 Typical stages in a food supply chain. (Source: Authors’ own)](image-url)
that can be tracked via GPS. Satellites and GPS have begun to play an extremely important role in the management of international supply chains (Billing and Bryson 2019). The core competency of logistics management service firms is thus centred on IT rather than transportation.

A total supply chain solution must be developed for the management of a supply chain. Food products must always be stored appropriately, for example. Meat or complete dishes must meet the supermarket’s specification and they must be delivered on time. Furthermore, health and environmental considerations require that the primary producer of the meat, the farmer and the slaughterhouse must be identified and, in many cases, even by the final consumer. All this must be achieved by supply chain logistics systems that are able to compete on price by providing inexpensive but high-quality goods. All this requires logistics services involving one or more service firms, or internal logistics management by a manufacturing firm or retailer. Logistics is a core element of production processes and may be a primary source of good/product differentiation. This is to argue that a company’s goods/products, production processes and logistics operations all contribute to enhancing competitiveness through differentiation (see the analysis of Zara in Chap. 14 section 14.4).

### 11.5 Types of Logistics

#### 11.5.1 Inbound Logistics

Inbound logistics, or backward linkages in a supply chain, involves procuring inputs that are incorporated into production and service processes. These are intermediate inputs into production systems. A service business creates value through, for example, converting expertise, or knowledge, into ‘products/goods’ and this requires that inputs are delivered on time. The procurement of any inputs on time, at the point of use, and at minimum cost is the primary aim of inbound logistics. This includes transportation during procurement activities and, if appropriate, the storage, handling and overall management of an inventory of inputs. For many service businesses, these requirements will be less complex than is the case for manufacturing businesses but sourcing, order placement, transportation, receiving and storage must still be undertaken with a view to keeping down system costs.

#### 11.5.2 Outbound Logistics

Outbound logistics, or forward linkages in a supply chain, are tasks involving the delivery of goods and services to customers. This usually includes items that possess more value, following
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the conversion of inputs, in line with the actual or anticipated needs of customers or clients. For some services this involves the assembly of inputs to produce service experiences. Shipment sizes, modes of transport to be used, or delivery time expectations will differ from those related to inbound logistics. Inbound logistics frequently involves the movement of larger quantities of inputs or of a continual stream of inputs in supply chains that have been developed around a just-in-time approach. Outbound logistics involves the delivery of low volumes to a single customer. This involves low quantities, but at frequent intervals. Outbound logistics must be managed to optimize systems, keep costs under close control but with the added requirement of ensuring maximum customer satisfaction. This is where companies like Amazon and Zara, the fast fashion clothing retailer, compete by integrating smart supply chain management logistic systems into their business models (see Chap. 14).

The maritime industry is an example of the application of IT to increase efficiency of outbound logistics. Prior to the development of container-based transportation systems, goods were transported by lorries to harbours and ships were then loaded by dock workers. When a ship arrived at ports, goods were then unloaded using labour intensive processes. Goods were manually loaded on to lorries and transported to customers. This labour-intensive supply process could take weeks and the labour was heavily unionized. The introduction of containers transformed logistics (see Chap. 3). Containerization is a system of intermodal freight transport using intermodal containers, or shipping containers, fabricated to standardized dimensions. Containers are handled using a completely mechanized system using cranes and special forklift trucks. In a container logistics system, goods are loaded into containers by the sender. The containers are transported by lorries to a port where an automatic system loads them on to a container ship. Loading is a rapid system based on algorithms intended to enhance the efficiency of the loading and unloading process. The turnaround time between arrival and departure decreased and this increased the effective use of merchant vessels. Containers are placed within the ship in the order in which they will be unloaded. Containerization led to major redundancies in the logistics system. Transportation became less labour intensive and much more capital intensive.

Containerization has made a major contribution to internationalization. It is much faster to move raw materials and completed goods along supply chains. This has contributed to the ongoing fragmentation of supply chains. Containers are continuously tracked and monitored. Technological innovation has transformed logistics through the application of innovations that commenced with the introduction of the container and continued with innovations enabled by GPS and with experiments in autonomous ships. Containerization has been the basis for the creation of large international shipping companies including the Danish company Mærsk and the Swiss-based Mediterranean Shipping Company. These large logistics providers have developed into total logistics service companies providing complete solutions to the management of supply chains. They invest in lorries, containers, harbours, warehouses and complex IT systems. IT systems include platforms to track containers and inventory and algorithms intended to increase the efficiency of company operations including maximizing asset utilization.

11.5.3 Reverse Logistics

Reverse logistics involves the return of goods to a producer including goods for reuse or recycling and for repair or repurposing. Any logistics process that occurs after a good or service has been delivered to a customer involves reverse logistics. The increase in e-commerce is associated with customers increasingly returning goods. They have the legal rights to do so and logistics services must deal with this situation effectively.

Reverse logistics is also required in circumstances where providers, seeking to maintain or expand market share, make claims about a service or a good over a period that are not fulfilled. Such warranties have a basis in law and require suppliers to facilitate systems for customers to
return items for replacement, repair, or possibly a refund at companies’ expense. Again, the logistics for managing these arrangements are designed not only to be efficient but also as cost effective as possible. The rapid rise of Internet retailing has reinforced the importance of reverse logistics since deliveries can be mislaid en route, goods damaged in transit, delivered to the wrong address or incorrectly assigned to customers. Likewise, a defective service or good invariably triggers a recall, especially if there are safety risks, quality standards or expiry dates involved, by suppliers who are anxious to protect their market image or brand loyalty for a service or good.

11.5.4 Third-Party Logistics (3PL)

Businesses that offer one or an array of logistics-related services to other firms are often described as third-party logistics (3PL) providers (Skjøtt-Larsen 2000). They enable businesses to outsource some or all their logistics needs. These are specialist providers of outsourced logistics services. Here it is worth noting that logistics is capital intensive and is a specialist activity. For smaller firms, outsourcing to a specialist logistics provider enables them to benefit from economies of scale and scope including, for example, part loads that are shared with other companies. Some examples include: distribution management and public/contract warehousing (e.g. provided by companies such as Exel, Caterpillar Logistics), freight (or transportation) management (Fedex Supply Chain, UPS, DHL Supply Chain and Global Forwarding, Ryder Supply Chain Solutions), financial-based 3PL (GE Information Services) and information-based 3PL. The latter is a recent addition that supports Internet-based, business-to-business and electronic markets/transactions (FreightQuote, uShip). 3PL incorporates a wide range of logistics services whose utility for service businesses varies depending on, for example, whether they are in retailing or in, say, investment management.

Hertz and Alfredsson (2003) (see also Langley et al. 2008) group 3PL providers into four categories:

- **Standard 3PL providers**: The most basic form performing activities such as pick and pack, warehousing and distribution (business). This is often not the primary activity of these firms.
- **Service developers**: Offer clients advanced value-added services such as tracking and tracing, cross-docking, specialist packaging or a bespoke security system. These providers are IT oriented and are most suited to clients exploring approaches to better incorporate IT into their logistics processes.
- **Customer adapters**: The provider is invited to take complete control of clients’ logistics activities (Grawe et al. 2012). The objective is to improve efficiency and cost-effectiveness of existing services rather than the provision of new services.
- **Customer developers**: The provider not only controls the existing logistics operations of clients but will also embed itself to identify and implement new customers and ways of developing and introducing supporting logistics (Soinio et al. 2012). In this case, the customer developer plays an increasingly strategic role in customers’ activities and in identifying new ways of applying logistics solutions to capture additional value for customers.

11.5.5 Fourth-Party Logistics (4PL)

Developments in 3PL have led to the emergence of 4PL logistics solutions involving the integration of resources to build and run total supply chain solutions sold as a total service to clients outsourcing their logistics and supply chain management requirements (Yao 2011). 4PL is a new concept in supply chain outsourcing. It reflects on-going rapid advances in technology over the last 20 years and is therefore a further refinement of the 3PL approach.

The application of 3PL by businesses to enhance the application of logistics and supply chain management has focused on managing larger inventories, increased the speed of transportation solutions or the provision of on-site service engineers but as part of a business environment that incorporates new activities such
as e-procurement, complete supply visibility, virtual inventory management and the adoption of appropriate integrating technology. 4PL providers, therefore, integrate supply chains comprising the assembly and management of their own resources, capabilities and technologies with those of their clients delivering comprehensive supply chain solutions. This may include leveraging the competencies of other 3PL providers and business process managers to deliver a supply chain in which the 4PL providers are the centralized hub. 4PL providers will have many clients ensuring that their capital investment benefits from economies of scale. Clients benefit from accessing specialist expertise, but also the extended geographic reach that can be developed by specialist 4PL providers. Here it is important to remember that logistics and supply chain management is at the heart of all GVC or GPN. Thus, the governance of the relationships between logistics and supply chain management service providers and their clients plays a critical role in client competitiveness. This is the case for every firm; all firms must manage inter- and intra-company flows combined with flows of goods to end consumers.

11.6 Outsourcing to 4PL Service Companies

The advantages of outsourcing logistics to a specialized 4PL service company is seen in the case of Corus (now part of Tata Steel) in the UK. Their logistics operations were organized locally with no coordination resulting in inefficiencies and problems with supply chain coordination. Corus outsourced all inbound and outbound logistics to the Transport Development Group (TDG), a 4PL provider. This increased the delivery-on-time and reduced transport costs (Potter and Mason 2015).

11.6.1 Outsourcing Logistics

Businesses can develop an internal solution to logistics supply and delivery, or they can outsource this function to specialized logistics service providers (see Chap. 8 on outsourcing).

Whether a business operates from a single location or from multiple locations it will need to consider logistics requirements at some stage in its development. Most of the issues to be considered will arise from whether to outsource logistics to 3PL or 4PL providers and these may only arise when, service businesses become much larger. Size means that it may no longer be cost-efficient to use management time within the business on procurement, inventory control, shipping and storage on an ad hoc basis. A business must either develop an in-house logistics division or outsource to a specialist provider.

Some of the advantages of applying a 4PL solution include:

1. Access to state-of-the-art technology and software.
2. Application of technology to the best possible effect.
3. Facilities and space appropriate to the tasks that are outsourced.
4. Access to resources and levels of flexibility to fulfil client requirements at different times and at different locations.
5. Capability to manage the expectations of several clients simultaneously.

11.6.2 Investment

Supply chain management involves decisions regarding capital investment in logistics operations, compared to investments in a company’s core operational activities. This type of investment decision includes the opportunity costs between investing in production operations compared to investing in logistics. Outsourcing is one solution, but the decision must reflect the needs of each business. But there are also disadvantages in outsourcing logistics and supply chain management. These include:

1. Loss of control over logistics operations, especially in relation to quality control or the nuances of trading with customers of the service business that have well-understood, but variable, expectations.
2. Failure by 3PL providers to meet expectations perhaps resulting in reputational damage for service and manufacturing businesses.
3. Operational problems arising from poor communications between the parties.
4. 3PL failure.
5. Conflicts between the strategic objectives of the service or manufacturing business and those of the 3PL provider.
6. Use of a 3PL provider with limited or no knowledge of the services or goods provided by the client.
7. Reduced ability to gather and analyse data about customers that will help with targeted marketing, continuous improvement programmes, or cost optimization.

The downsides from commissioning 4PL providers are much the same as those for 3PL providers although the financial consequences for the affected service or manufacturing businesses may be much more damaging. This is because the advantages of using 4PL providers are potentially more comprehensive impacting on all operational functions including: enhanced product/good quality, product/good availability and improved customer service—all facilitated by the application of leading technology that generates revenue growth; operational efficiencies, process enhancements and procurements, complete outsourcing of supply chain functions rather than just selected components that will create overall cost reductions for service or manufacturing businesses; reductions in fixed capital investment following on from capital asset transfer and enhanced asset utilization.

The outsourcing decision must include a company’s internal logistics. For a retail company this includes internal accounting of goods, stock and management of when individual shops, for example, supermarkets, should receive deliveries. For large retail chains this is based on information flowing between each retail outlet and the logistics and supply chain management function. Often this includes information from RFID tags and bar codes. Deciding to outsource logistics and supply chain management partly depends on a company’s previous history of managing these activities. A company may not be able to afford to invest in the provision of internal logistics infrastructure. A question to consider is whether an external logistics services company can handle that part of a supply chain which requires knowledge about the client company’s internal procedures and routines. Will a retail company outsource internal logistics or does this expose the retailer to risks associated with failure of the logistics provider to meet the company’s needs? An internal logistics facility might be able to provide a more customized service with fewer faults. Outsourcing that involves the closure of an internal logistics division, or its transfer to a third-party provider, might mean that the company no longer has the capabilities or capacity to understand its own internal logistics requirement.

Effective decision-making about supply chain logistics requires close attention to value chain analysis including considering where value creation occurs, profitability linked to logistics and supply chain management and the creation and co-creation of customer value.

## 11.7 Value Chain Analyses

A value chain is a chain of value-added activities; products/goods pass through the activities in a chain, gaining value at each stage (Sundbo 2011). Value chain analysis provides strategic focus in understanding a company’s operations and strategy. Adding value to products/goods as they pass through a chain of activities has been emphasized by Michael Porter (1998). Value chain analysis was introduced to analyse market situations and to create marketing strategies, but it also involves exploring the organization and management of a company’s supply chains (Huemer 2012). A supply chain can be conceptualized as a value chain where each step adds value to a good or task or destroys value. Both specialized logistics service firms and other businesses benefit from value chain analysis as this will identify potential and actual problems that enhance costs and reduce value. Value chain analysis contributes to assessing costs that might be reduced or impacted by a change in one of the chain’s processes.
Comparative value chain analysis enables a company to identify and explore competitor value chains identifying tasks, processes, operations and linkages within its own value chain that require improvement.

A value chain analysis involves exploring a supply chain’s operational activities. These include:

- Incoming supplies, materials, incoming shipping
- Storing and handling
- Outgoing shipping and logistics
- Customer service—includes tracking, coordinating, scheduling and reverse logistics
- Marketing, sales and customer satisfaction

The analysis should also include exploring related business activities including:

- Accounting and finance
- IT and systems support
- Legal issues including documentation related to exports and imports
- Environmental and climate issues and safety
- Personnel
- Innovation
- Corporate social responsibility

11.8 Supply Chain Challenges Facing Logistics Businesses

Businesses encounter several challenges that must be taken into consideration when analysing and planning a supply or value chain. These include:

11.8.1 Continued Growth of e-Commerce

E-commerce continues to grow, and new e-commerce business models emerge based on new approaches to logistics. On-line platforms, combined with the networking effect, open up possibilities for the creation of many new business models resulting in increased competition associated with disruptive innovation (see Chap. 3). Innovations in e-commerce have transformed high street retailing. This includes click and collect solutions linking e-commerce provision with high street stores.

Amazon has introduced Amazon Hubs as a brand to cover investments in Lockers and relationships with retail locations. Lockers are self-service kiosks where customers can collect and return Amazon parcels at any time. Counters are agreements that Amazon has negotiated with convenience or high street stores where customers can collect Amazon parcels. Once a parcel has been delivered to a Locker or Counter, then the Amazon e-commerce platform e-mails a collection barcode to customers.

E-commerce includes an increase in reverse logistics. Customers order goods that they do not want to keep resulting in increased returns. Some e-commerce retailers are identifying customers with exceptionally high return rates and developing strategies to reduce these.

11.8.2 Technology Matters

Information technology (IT), including sensors, operational systems and GPS tracking, are playing an increasing role in logistics management and have become core elements in transportation, sorting, storing and tracking technologies. Logistics service companies are capital intensive but are increasingly becoming much more technologically intensive. This includes the collection, management and application of Big Data and the development of new algorithms to manage supply chain logistics.

11.8.3 Understanding the Capabilities of Suppliers and Service Partners

Business partners’ capabilities are important because logistics service companies are dependent on inter-firm relationships. Of course, their customers—manufacturing or service companies requiring logistic services—are important, but
logistics service companies also have suppliers, for example, providers of IT systems and transportation equipment. Actual, or potential, suppliers may introduce innovations that could be important for logistics service companies. Logistics service companies may outsource some functions and often other companies are responsible for the management of part of their supply chain. Managing inter-firm relationships is critical to reduce problems that might undermine the quality of services provided.

11.8.4 ‘Customers as King/Queen’

Service marketing, and management research, has highlighted that customer satisfaction is critical for service businesses and for the quality of the service experience (Chap. 8). Logistics and supply chain management must not impact on the quality of the customer’s service experience.

11.9 Just-in-Time and Lean Production

Supply chains and logistics are central to the efficient management and delivery of service experiences and of goods. The rationalization principles that were developed in Japan in the 1980s and 1990s have been adopted by manufacturing industries globally. These principles also play an important role in logistics services. Logistics are at the centre of the rationalization approach to enhancing the efficiency of production systems.

Just-in-time approaches to the management of supply chains transformed manufacturing-based value chains. This system is based on the principle that goods or components should not be produced and shipped before demand and need is manifested. A car consists of a complex set of interchangeable modules with customers selecting from a range of options. Customers can order many variations of a car, but car manufacturers do not have to store all components required for all product/good variations. Customized cars are built to order, and this requires the design and management of just-in-time production processes.

The just-in-time principle challenges supply chain and logistics service providers. They must ensure that a component is available for integration into a good as it is required. Storing goods and components just-in-case they are required ties up capital in components and in storage facilities. A just-in-time approach transfers these costs to suppliers and to their logistics providers.

Just-in-time raises several important questions for logistics and supply chain management including:

1. How much capability and capacity should a logistics service firm have, at what time and at what locations?
2. What happens if the logistics service firm cannot fulfil the demands of the customer (the goods sender)?
3. Who is responsible for the supply—the sender, the receiver or the logistics service company?

Logistics service companies have to innovate to meet just-in-time demands, for example, by identifying new transport modes, introducing new IT systems that can track and manage the delivery process or new forms of employment that can ensure 24-hour delivery. These new forms of employment also include gig-style employment in which ‘employees’ are self-employed with limited employment rights (see Chap. 6).

Rationalization included the adoption of lean-based production systems and these have been applied to logistics and supply chain services (Arlbjørn et al. 2011; Tortorella et al. 2017). Lean requires a company to explore all procedures identifying redundancies including wasted time, material resources and storing capacity. The focus is on identifying waste and reducing costs. Nevertheless, these rationalization efforts must also focus on customer satisfaction. Lean involves the design of production and delivery procedures focusing on balancing investment with waste reduction. This is a strategy based on optimiza-
tion combined with customer needs involving prices and delivery options. A logistics and supply chain should adopt lean principles combined with contingency planning.

Supply chains may be differentiated or variegated; some customers require standardized and rationalized services whilst others expect customization including flexibility in the logistics system (Arlbjørn et al. 2011). The latter implies that logistics services, to a lesser degree, are no longer ad hoc services that are sold on a day-to-day basis, but instead logistics providers develop longer term relationships with their customers enabling them to invest in the creation of flexible supply chain systems (Tortorella et al. 2017).

Lean supply chains are difficult to establish (Tortorella et al. 2017). Logistics services companies have many different customers with different demands and satisfaction levels. Supply and logistics include many different processes and related tasks that may be difficult to identify, analyse and change. Often a logistics service provider only takes responsible for one part of a supply chain process. The challenge is that the creation of a total lean supply chain is dependent on a company working with many different organizations.

Case: Lenovo—Supply Chain Complexity, Management and Risk Reduction through AI

Global value chains are becoming increasingly complex as companies continue to apply and develop complex spatial divisions of labour resulting in the continual fragmentation of supply chains. Longer supply chains tend to be much more complex and are more difficult to manage. To enhance decision-making companies are incorporating artificial intelligence (AI) into the management of their supply chains.

IBM has developed a Supply Chains Insights program that is based on the application of AI to identify operational cost reductions that will enhance incremental revenue accumulation. Lenovo, the PC manufacturer, joined IBMs Watson™ Supply Chain Fast Start program to complete an analysis of its supply chain using IBM Supply Chain Insights. This took five weeks. The outcome was an analysis that enabled Lenovo to optimize decision-making including the identification of cost savings and up to a 95% increase in Lenovo’s reactions to supply chain disruptions with associated reductions in risk.

The context for Lenovo was the on-going commoditization of the PC market leading to a reduction in profit margins. To enhance Lenovo’s ability to compete it is essential that it orchestrates its global supply chain effectively with a focus on cost-effectiveness. Lenovo’s supply chain contained many nodes, and each was generating significant quantities of data every day. This data stream contained important information that Lenovo could use to enhance supply chain management. Nevertheless, the problem was the volume and velocity of this data stream. IBM’s application of AI to the analysis of this data stream enabled Lenovo rapidly to identify disruptions in any link in the supply chain and to calculate the financial implications. It also ensured that Lenovo could engage in strategies that would mitigate the impacts of any disruptions. Part of this approach enabled Lenovo to introduce new approaches to production including ‘available to promise’ (ATP). The company is now able to precisely estimate deliveries to clients in real time. This adds an additional dimension to Lenovo’s ability to compete in a highly competitive market.

11.10 Wrapping Up

This chapter has highlighted that logistics services, supply chain analysis and management play a critical role in the international economy and in global value chains. Logistics, and the management of supply chains, are important capital-intensive services and they are services that have become saturated with big data and data analytics. Supply chain failure results in significant disruption and such disruption usually is caused by the complex interplay between companies and infrastructure systems that underpin logistics systems. Supply chains and logistics play a key role in underpinning or facilitating internationalization, including the international-
ization of service businesses (see Chap. 10) and also manufacturing companies. The latter includes flows of data, money, people and expertise and it is to this topic that we now turn our attention.

The on-going fragmentation of global value chains has been supported by innovations in transportation infrastructure, including ports, airports and containerization and logistics. Developments in approaches to logistics play an important role in the emergence of new business models (see Chap. 14) and in facilitating flows of raw materials, people, expertise and goods between places. Logistics is supported by global financial services including the insurance industry, but also leasing companies that finance the purchase of aircraft and merchant vessels. There are many different types of supply chain and each type requires a different type of logistics solutions including supply chains that transport customized products compared to those involved in transporting standardized goods. Logistics has always been a capital-intensive industry, but there has been an increase in the expert intensity of this sector. Big data from embedded sensors combined with AI is playing an increasingly important role in the management of logistics service functions.

**Learning Outcomes**

- Logistics services play a key role in catalysing internationalization including the on-going fragmentation of GVC/GPN.
- To enhance decision-making companies are incorporating AI into the management of their supply chains.
- Logistics are at the centre of the rationalization approach, that emerged in Japan in the 1980s, to enhance the efficiency of production systems.

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Useful Websites

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