“Enhanced data management techniques for real time logistics planning and scheduling”

Deliverable D8.4: New/Emerging Business Model Report – Release 2

Dissemination level:
☒ Public ☐ Confidential, only for members of the consortium (including the Commission Services)

Version number: 1.0

Submission deadline: 30/10/2019

www.logistar-project.eu

DOCUMENT INFORMATION

Authors

Name	Organisation
Michael Hatfield	MDST

Reviewers

Name	Organisation
Sharon Cox	MDST
Naia Merino	DEUSTO
Leire Serrano	DEUSTO
Andrew Palmer	Preston

Document control

Version	Date	Comment
0.1	07/11/2019	First draft
0.2	27/11/2019	Added comments from partners
1.0	28/11/2019	Final version

Document approval

Version	Date	Partners
1.0	28/11/2019	All partners

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

BASIC PROJECT INFORMATION

Horizon 2020 programme

H2020 - Mobility for Growth- 5-2-2017. Innovative ICT solutions for future logistics operations

Grant Agreement No. 769142

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

TABLE OF CONTENTS

LIST OF FIGURES

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Executive Summary

LOGISTAR is a Horizon 2020 research project, funded by the European Union (EU). It consists of pan-European partners from academia, and the software industry alongside both shippers and forwarders. The key aim of the project is the development of a 'digital tool' to allow:

- Effective planning and optimisation of transport operations in the supply chain;
- Securing horizontal (and vertical) collaboration;
- Real-time decision-making; and
- Real-time visualisation for freight transport.

Task 8.3 considers *New Logistics Business Models*. The main purpose of the task is to *"analyse the potential future business models for logistics that are likely to emerge up to (say) 2030, then analyse the existing business models that are deployed to facilitate collaboration and the planning and implementation of dynamic transport services."* The task commenced at the outset of the LOGISTAR project with a requirement to produce annual updates. An initial written report was presented in M6 (D8.3 Release 1, November 2018). This written report (D8.4 Release 2) forms the first Task 8.3 annual update. Building on the information and conclusions contained in the initial report, the purpose of this report is twofold:

1. It examines in more detail some of the flows/links within the main logistics business models that have been adopted by both the retail and manufacturing sectors. It identifies the key commercial players involved and how they operate. It addresses the extent to which collaboration already occurs, alongside identifying where there is potential for further collaboration. It also identifies where there are likely to be opportunities for collaboration where it currently does not exist.

2. Derived from the outputs of (1) above, the report identifies where the potential market opportunities are likely to exist for the LOGISTAR 'digital tool'. This output can effectively form the starting 'input' for the *exploitation and implementation* plan; it will identify the key sectors and operators where LOGISTAR could have a role and hence where any marketing activity should be focused (and conversely the sectors/players not likely to be interested).

Logistics Business Models

The flow diagrams in Annex 1 provide a visual description of the models (in terms of the flows of goods between the various stages of the supply chains). Models 1 and 2 plus the E-commerce 'add-on' in Model 3 effectively form the 'new' logistics business (supply chain) models that have emerged over the past 10-15 years, driven principally by the growth of the internet alongside other factors such as the liberalisation of parcel and courier networks in the EU. The remainder are the more established business models of logistics supply chains.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Collaboration

Two forms of commercial collaboration can be identified, namely:

- Vertical collaboration; and
- Horizontal collaboration.

The concept of *vertical collaboration* covers the process whereby companies enter into commercial relationships with other companies operating at different levels of trade in order to get their goods or services to market. In the logistics sector vertical collaboration is already commonplace and essentially covers the out-sourcing (by manufacturers, suppliers and retailers) of transport and other logistics functions (e.g. warehousing and inventory management) to specialist operators known as third party logistics providers (3PLs).

Where companies operating at the same level of production or distribution in a market form any kind of commercial agreement it is defined as *horizontal collaboration*. In the logistics sector, at the operational level horizontal collaboration effectively covers agreements to share storage or transport capacity. In its simplest form it covers:

- Two or more manufacturers/retailers agreeing to share a distribution warehouse to store their respective products; and
- A transport operator agreeing to convey cargo on behalf of another transport operator, for an appropriate fee, in order to fill empty capacity.

Horizontal collaboration often arises through formal agreement between two or more shippers/3PLs to share or jointly use their logistics capacity (active collaboration). While shippers do not directly set out to collaborate with others, it is often the case that goods despatched by multiple shippers (often competitors) will at some point in the supply chain end up being handled by a common 3PL operator and share the same logistics capacity (storage and/or transport). This could be termed 'passive' or 'accidental' collaboration. The process of out-sourcing logistics functions therefore facilitates (unwittingly) horizontal collaboration between multiple shippers.

Logistics Providers

In some cases, shippers (manufacturers and retailers) will undertake to deliver their goods to the next stage in the supply chain themselves, using their own transport equipment. These are often referred to as *'own account'* operations. Operating and licencing regulations restrict the level of collaboration that own account operations can enter into with other companies.

Retailers and manufacturers will generally out-source much of their transport and other logistics functions to specialist service providers (vertical collaboration). These are known as *third party logistics operators or 3PLs.* At the simplest level, a 3PL will only undertake road haulage or rail freight operations. At the other end of the scale, a large multi-national 3PL will provide the full range of out-sourced logistics services (transport, warehousing, inventory management etc..)

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

It is common place for 3PLs to seek to optimise the use of their storage infrastructure and transport equipment. This is undertaken by storing several customers' products in one warehouse location and, where appropriate, utilising their transport fleets to perform load-sharing and multi-drop operations for different retailers or manufacturers. This is the 'passive' horizontal collaboration as described, whereby multiple shippers effectively collaborate as their cargo ends up being handled by the same 3PL operator. Also, 3PLs actively collaborate by sub-contracting cargo to one another (horizontal collaboration), thereby reducing empty running or ensuring vehicle fill.

It is also important to appreciate that most organisations which despatch cargo (shippers) do so frequently (i.e. at least 5 days per week if not every day) and in sizeable volumes. Given this position, shippers will already have commercial arrangements in place to ensure that cargo is delivered to the next stage of the supply chain in a timely manner, and to maximise service levels and cost efficiency. These commercial arrangements are likely to include vertical relationships with contracted 3PLs, who consolidate cargo from multiple shippers to ensure that transport and storage capacity is utilised efficiently.

Market Opportunities

While collaboration (active and passive) is therefore already common practice, the LOGISTAR tool could find a significant role internally within existing large 3PLs, optimising the use of their transport equipment through the consolidation and load-sharing of cargoes from multiple shipper clients in real time. It could also help facilitate the further sub-contracting of cargoes between 3PLs, providing opportunities to cooperate in order to 'fill' transport capacity in real time.

A series of case studies is presented to illustrate how different types of 3PLs are able to facilitate load sharing of cargo. The LOGISTAR tool will therefore need to be able to enhance what is already standard business practice in the logistics arena.

Key areas within supply chains where there are likely to be opportunities for the LOGISTAR tool include:

- Flows of goods from manufacturers and supplier to retailer NDCs and RDCs; and
- Flows of goods from retailer NDCs to RDCs or 'Cross Dock' facilities.

It is intended that the conclusions outlined above will form the basis of an interview programme with a number of key market operators in the first half of 2020. These emerging conclusions will be 'tested' with these key players in the market.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

1. Introduction

LOGISTAR is a Horizon 2020 research project, funded by the European Union (EU). It consists of pan-European partners from academia, and the software industry alongside both shippers and forwarders. The key aim of the project is the development of a 'digital tool' to allow:

- Effective planning and optimisation of transport operations in the supply chain;
- Securing horizontal (and vertical) collaboration;
- Real-time decision-making; and
- Real-time visualisation for freight transport.

The main objective of LOGISTAR is:

> *"To allow effective planning and optimising of transport operations in the supply chain by taking advantage of horizontal collaboration, relying on the increasingly real-time available data gathered from the interconnected environment. For this, a real-time decision making tool and a real-time visualization tool of freight transport will be developed, with the purpose of delivering information and services to the various agents involved in the supply chain, i.e. freight transport operators, their clients, industries and other stakeholders such as warehouse or infrastructure managers."*

Within this main objective are a set of specific ones related to 3 distinct project areas:

PROJECT AREA	SPECIFIC OBJECTIVES
Real-time decision making tool for planning of logistics operations	To *increase by 10% the load factors of freight vehicles* derived from the optimization techniques applied to freight deliveries planning.
	To *shorten by 10% the delivery routes* thanks to applying planning of optimal routes relying on synchromodality, being continuously updated in case of disruption.
	To *increase the reliability and efficiency of logistics services* by predicting events and incidents affecting the supply chain and by providing alternative routes in real-time to these disruptions.
	To *facilitate the management of logistic operations* by providing real-time supply chain visibility through dashboards not only displaying information but also showing deviations, alerts or recommendations to take actions.
	To *boost horizontal collaboration among logistics agents* focusing on full truck load (FTL) backhaul opportunities, consolidation of less than truckload (LTL) deliveries, supply chain collaboration and synchromodal opportunities.
Real-time information on synchromodal transport	To *increase the visibility of the delivery* derived from the use of sensors to monitor the goods shipped and boosting to share logistic data&information among agents.
Rest of the Implementation of the project	To *promote the sharing of open data in the logistics sector* by promoting the benefits of collaboration and Big Data analytics across stakeholders.
	To *enable new market opportunities* on the logistic information services sector, by developing new business models focused on data and high value service delivery, and exploring concepts such as "sharing" rather than "owning" transport assets. The policy and legal dimension will also be studied.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Task 8.3 considers *New Logistics Business Models*. The main purpose of the task is to *"analyse the potential future business models for logistics that are likely to emerge up to (say) 2030, then analyse the existing business models that are deployed to facilitate collaboration and the planning and implementation of dynamic transport services."* The task commenced at the outset of the LOGISTAR project with a requirement to produce annual updates.

As part of this task, an initial written report was presented in M6 (D8.3 Release 1, November 2018). This covered the following topics:

- It provided an overview and description of the main logistics supply chain models that have been adopted by both the retail and manufacturing sectors. It identified the key commercial players involved at the various stages of the supply chain;
- It presented a review of the use of existing technology used for planning and optimisation of transport operations in the supply chain; and
- Considered the extent to which the key players in the logistics industry already collaborate.

The report represented our preliminary thoughts on these topics derived from our extensive knowledge of the logistics sector alongside some primary desktop research. It was intended to inform the early stages of the development of the LOGISTAR 'digital tool'.

This written report forms the first Task 8.3 annual update (D8.4 Release 2). Building on the information and conclusions contained in the initial report, the purpose of this report is twofold:

1. It examines in more detail some of the flows/links within the main logistics business models that have been adopted by both the retail and manufacturing sectors. It identifies the key commercial players involved and how they operate. It addresses the extent to which collaboration already occurs, alongside identifying where there is potential for further collaboration. It also identifies where there are likely to be opportunities for collaboration where it currently does not exist.

2. Derived from the outputs of (1) above, the report identifies where the potential market opportunities are likely to exist for the LOGISTAR 'digital tool'. This output can effectively form the starting 'input' for the *exploitation and implementation* plan; it will identify the key sectors and operators where LOGISTAR could have a role and hence where any marketing activity should be focused (and conversely the sectors/players not likely to be interested).

The analysis presented in this report includes a number of 'case studies'. It is intended that the outputs from this report will form the basis of an interview programme with a number of key market operators in the first half of 2020. The emerging conclusions will be 'tested' with these key players in the market.

Separately, but related to and informing Task 8.3, MDS Transmodal presented Deliverable 1.5 (D1.5) in M12 (May 2019). This was a written report detailing and discussing the legal and regulatory position with respect to collaboration (Horizontal and Vertical) within the logistics sector.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

2. Background: Logistics Business Models and Key Players

2.1 Logistics Business Models

The November 2018 D8.3 initial report identified seven main logistics business (supply chain) models that have been adopted by both the retail and manufacturing sectors, as follows:

1. E-Commerce Supply Chain 1;
2. E-Commerce Supply Chain 2;
3. Bricks & Mortar plus E-Commerce from Store Retailer;
4. Shared User Networks;
5. Basic Supplier to Retailer;
6. Flow Diagram – Retail Factory Gate Collections; and
7. Consolidating Supplies.

The flow diagrams in Annex 1 provide a visual description of the models (in terms of the flows of goods between the various stages of the supply chains). Models 1 and 2 plus the E-commerce 'add-on' in Model 3 effectively form the 'new' logistics business (supply chain) models that have emerged over the past 10-15 years, driven principally by the growth of the internet alongside other factors such as the liberalisation of parcel and courier networks in the EU. The remainder are the more established business models of logistics supply chains.

It should be noted that they are 'models' of logistics supply chains; they provide a simplified description of reality in order to assist in explaining how companies organise the movement of goods from producers/suppliers to the end-user, as well as the key commercial players involved. These models are not intended to be a perfect 'fit' with an individual organisation's actual supply chain, though examples of companies which have broadly adopted each model were given in the initial report. It may be the case that an individual company's supply chain could be an amalgamation of two or more models, or they may have adopted more than one model for different parts of their businesses. For example, a retailer's 'direct to home' E-commerce operation might reflect Model 2, which is operated alongside its established network of retail outlets broadly following Model 3.

2.2 Collaboration

Two forms of commercial collaboration can be identified, namely:

- Vertical collaboration; and
- Horizontal collaboration.

The concept of *vertical collaboration* covers the process whereby companies enter into commercial relationships with other companies operating at different levels of trade in order to get their goods or services to market. In a vertical relationship, the product or output of one business is the input for another. As will be discussed further below, in the logistics sector vertical collaboration is already commonplace and essentially covers the out-sourcing (by manufacturers, suppliers and retailers) of transport and other logistics functions (e.g. warehousing and inventory management) to specialist operators known as third party logistics providers (3PLs). It can also cover the leasing of transport equipment and renting warehouse floor space capacity.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Where companies operating at the same level of production or distribution in a market form any kind of commercial agreement it is defined as *horizontal collaboration*. In the logistics sector, at the operational level horizontal collaboration effectively covers agreements to share transport and/or storage capacity (though data sharing, purchasing arrangements and R&D can also be included). There are effectively three basic forms of this collaboration, as illustrated in the flow diagrams below.

Two or more cargo owners (e.g. manufacturers or suppliers) agree to share a single storage facility (such as a distribution warehouse) to store their respective products. This would most likely occur where the manufacturers/suppliers were located in close proximity and/or where they are supplying the same retailers. In practice, the horizontal collaboration could have been the result of both cargo owners having contracted with a common 3PL (vertical collaboration), which uses a single facility to store the cargo.

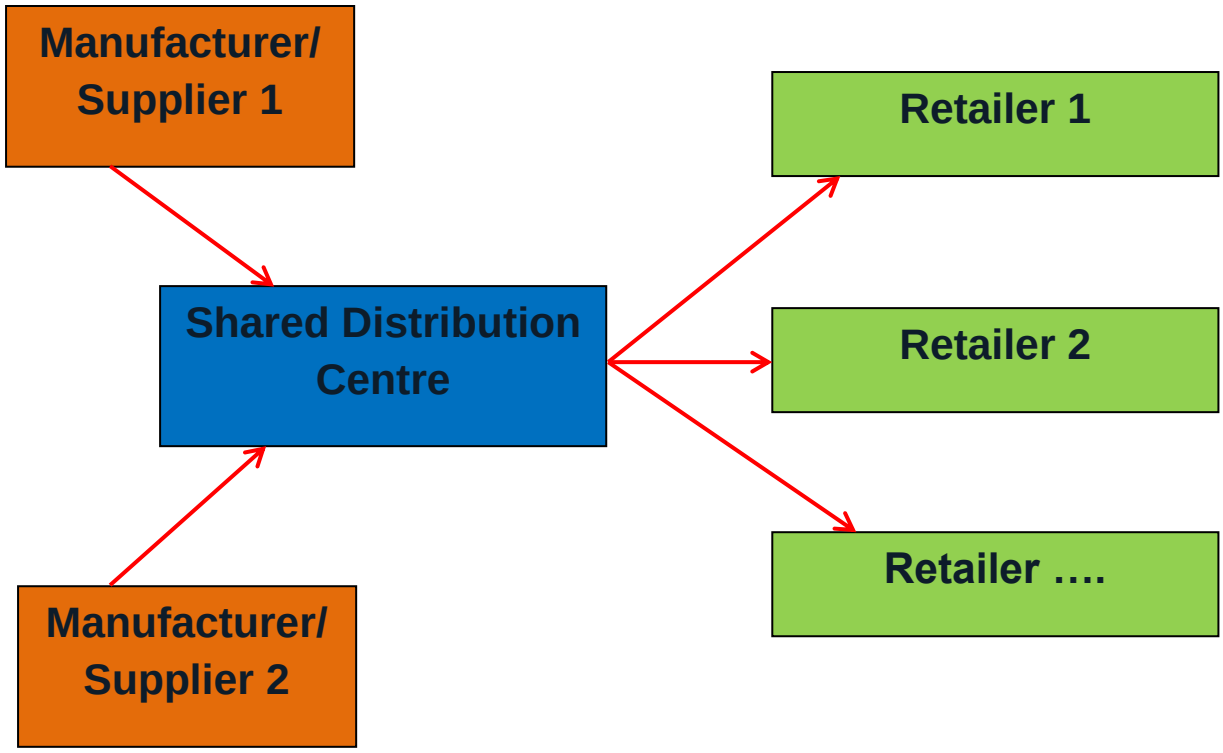

Figure 1 Sharing Storage Capacity

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Where a transport operator agrees to convey cargo on behalf of another transport operator (for an appropriate fee) in order to fill empty capacity. In this case, the first operator (Red) could be conveying cargo from A to B, whereas the second operator (Blue) has a contract to move goods from B to A. If both transport operators decide to move the goods themselves by road haulage, they would need to re-position their vehicles back to their respective origins, running empty on the return legs. However, the two operators could collaborate whereby the second operator sub-contracts the consignment to the first operator, thereby ensuring that the first operator's goods vehicle runs 'full' in both directions.

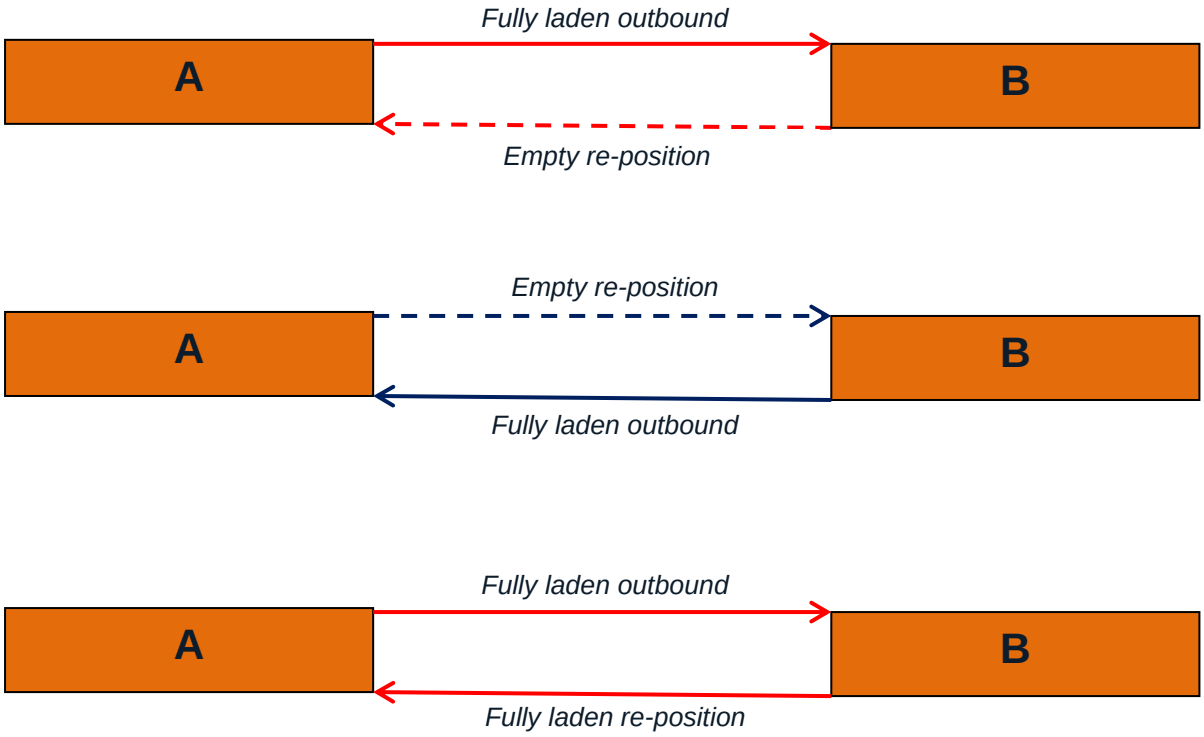

Figure 2 Sharing Transport Capacity (Utilising Empty Capacity)

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Where a transport operator agrees to convey cargo on behalf of another transport operator (for an appropriate fee) in order to fill what would otherwise be partially laden capacity. In this case, the first operator (Red) could be conveying a part-load of cargo from A to B i.e. the transport unit is less than fully laden. Likewise, the second operator (Blue) could also be conveying a part-load of cargo from A to B. If both transport operators decide to move the goods themselves by road haulage, they would end up running partially laden goods vehicles from A to B. However, the two operators could collaborate whereby the second operator sub-contracts the consignment to the first operator, thereby ensuring that the first operator's goods vehicle runs 'full' for most of its journey.

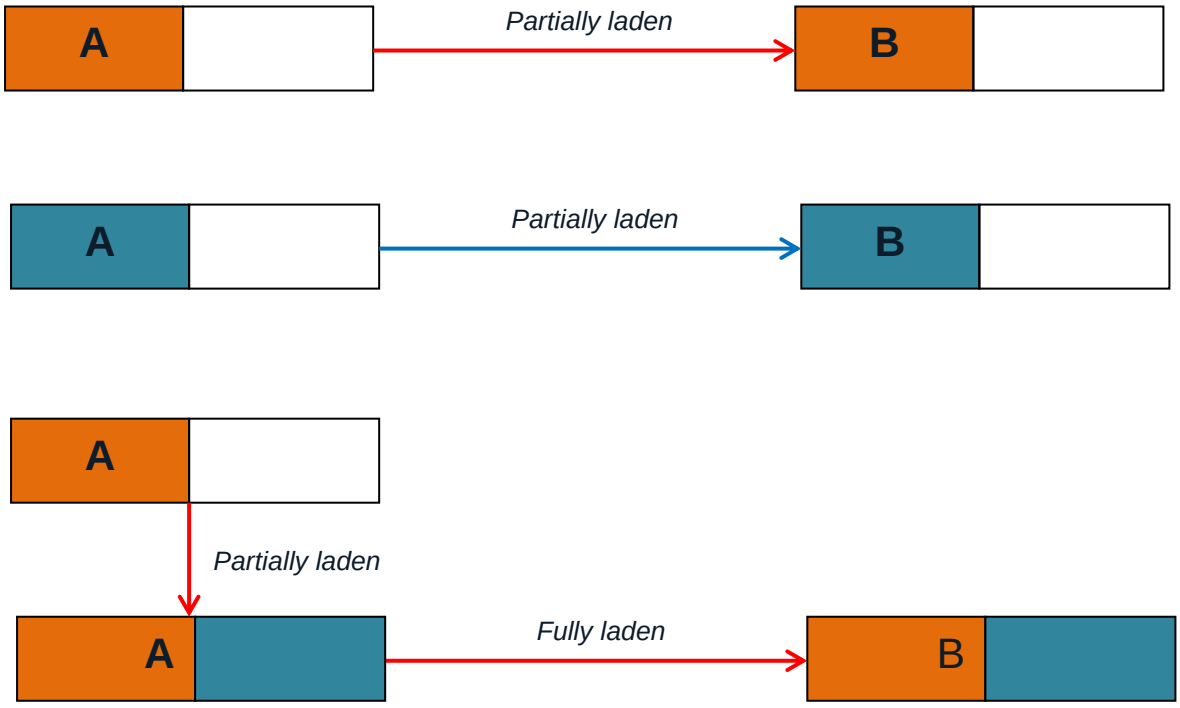

Figure 3 Sharing Transport Capacity (Combining Loads to Fill Transport Capacity

The logistics market has devised a number of systems by which storage and transport capacity is shared between multiple shippers and 3PLs, albeit these are all essentially variations on the three forms as described. Some of the more common ones are explained through the remainder of this report.

Horizontal collaboration arrangements are entered into as a means of increasing efficiency/productivity, thereby reducing operating costs per unit moved (potentially through economies of scale). Such collaboration often arises through formal agreement between two or more shippers/3PLs to share or jointly use their logistics capacity (as per Figures 1-3 above). This capacity sharing could be long-term regular/frequent arrangements (agreement by contract) or undertaken on an ad-hoc basis when required (most likely at pre-agreed rates). This could be termed 'active collaboration' in that the shippers/3PLs concerned will actively seek out collaborators and subsequently enter into collaborative partnerships in order to gain the economic efficiencies. Active collaboration often comes about through the commercial

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

knowledge or personal contacts of logistics industry professionals, though in some cases it may simply be a case of an 'accident of geography'.

As will become apparent during this report, horizontal collaboration is already common practice within the logistics sector. While much of this is 'active collaboration' (as described), it is often coincidental rather than by design. This is because goods despatched by multiple shippers (often competitors) will at some point in the supply chain end up being handled by a common logistics operator and share the same logistics capacity (storage and/or transport). This could be termed 'passive' or 'accidental' collaboration, in that shippers do not directly set out to collaborate with other shippers (including both competitors and complementary companies). As will be described in the case studies following, a single specialist logistics provider will have multiple clients; these organisations will actively seek to combine loads from multiple shippers in order to maximise vehicle fill and reduce/eliminate empty running. Goods from multiple shippers may also pass through the same warehouse capacity. In practice, therefore, 3PLs are unwittingly facilitating horizontal collaboration between shippers.

It is therefore within the concept of horizontal collaboration that the LOGISTAR tool is likely to offer the greatest opportunities for increasing efficiencies in the supply chain. While collaboration is already common practice, the digital tool would potentially allow multiple shippers and specialist logistics providers further opportunities to cooperate in order to 'fill' transport capacity in real time.

2.3 Logistics Providers

In some cases, shippers (manufacturers and retailers) will undertake to deliver their goods to the next stage in the supply chain themselves, using their own transport equipment and infrastructure, employing their own drivers and management systems etc.. (including related logistics functions such as storage). These are often referred to as *'own account'* operations. The initial report from November 2018 explains why some companies will undertake these functions in-house.

Operating and licencing regulations, however, restrict the level of collaboration that own account operations can enter into with other companies. For example, own account road transport operations are generally restricted (by licence) to only conveying their own cargo, either finished goods being despatched to customers or the collection of inbound raw materials/components. As a result, they are unable to share their transport capacity with other organisations, such as consolidating cargo to ensure vehicles operate fully laden or moving their cargo to eliminate empty running on the return legs.

However, it is now common practice for retailers and manufacturers to out-source much of their transport and other logistics functions to specialist service providers (vertical collaboration). These are known as *third party logistics operators or 3PLs.* The principal reasons driving the use of out-sourced 3PLs include:

- Perceived or actual cost savings. 3PLs are able to offer lower cost solutions through a mixture of competition to win/retain business, the ability to gain greater discounts on fleet equipment and operating goods vehicles more efficiently (ability to seek return loads and run vehicles full in both directions);
- Perceived or actual quality of service improvements. Competition to win and retain business results in a higher quality of service compared to own account operations; and

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

- To introduce new ideas and working practices. Competition to win/retain business can result in innovative ideas and solutions being designed and implemented to overcome management inertia to change.

Overall the idea behind employing a 3PL is based on the theory - and recent trends in commerce - that companies improve their performance by focusing on their core activities while out-sourcing activities viewed as peripheral to organisations which specialise in that field. For example, a retailer should focus on retailing, contracting out their distribution activities to companies whose core activity is logistics.

3PLs vary in size and in the range of logistics activities they undertake for their clients. The logistics activities provided generally cover the following:

- Warehouse or distribution centre operations;
- Stock control and inventory management;
- Order fulfilment;
- Packaging/labelling/bar coding;
- Removal/disposal of waste packaging
- Reverse logistics (management of order returns from end-users and waste packaging);
- Road haulage operations;
- Rail freight/intermodal operations; and
- Air freight operations.

3PLs can undertake one, some, or all of the functions listed. At the simplest level, a 3PL will only undertake road haulage or rail freight operations. The 'classic 3PL' will provide road haulage operations integrated with warehouse and distribution centre management services. At the other end of the scale, a large multi-national 3PL will provide the full range of services listed. Some 3PLs can also be sector, commodity or activity focused. For example, the main parcel couriers focus on moving small individual consignments for multiple shippers, while the so called 'palletline' (groupage) operators specialise in moving pallet-load quantities for shippers via hub and spoke networks.

In some cases, a shipper could have dedicated transport capacity provided by the 3PL i.e. vehicles assigned to that shipper by the 3PL and only moving goods for that shipper. There are often good operational reasons for this; goods vehicles will often need to reposition back to distribution centres with empty roll cages/pallets, returned stock or waste packaging, meaning there is no opportunity to utilise that transport capacity for other shippers i.e. that part of a 3PL's fleet being unable to participate in collaboration. This is often the case for supply chains serving multiple retail outlets (Model 3). Dedicated transport may also be serving warehouse capacity dedicated to a particular shipper. Again there are often good operational reasons e.g. the warehouse being equipped to only handle a particular commodity.

However, it is common place for 3PLs to seek to optimise the use of their storage infrastructure and transport equipment. This is undertaken by storing several customers' products in one warehouse location (as per Figure 1) and, where appropriate, utilising their transport fleets to perform load-sharing and multi-drop operations for different retailers or manufacturers. This is the 'passive' horizontal collaboration as described above; multiple shippers effectively

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

collaborate as their cargo ends up being handled by the same 3PL operator. Also, 3PLs actively collaborate by sub-contracting cargo to one another ('active' horizontal collaboration), thereby reducing empty running or ensuring vehicle fill (as per Figures 2 and 3 above). It is important to note that this collaboration can take place between different divisions of the same wider organisation (a single 3PL) where these divisions more or less operate as defacto different companies.

The ability to drive economies through scale in turn benefits the cargo owners as in theory they share in the benefit of reduced costs. By their nature, therefore, 3PLs are a shared logistics resource, allowing (passive) horizontal collaboration between multiple shippers (a single 3PL will be handling cargo for multiple shippers, many of whom will be direct competitors).

Therefore, while collaboration (active and passive) is already common practice, the LOGISTAR tool could find a significant role internally within existing large 3PLs, optimising the use of their transport equipment through the consolidation and load-sharing of cargoes from multiple shipper clients in real time. It could also help facilitate the further sub-contracting of cargoes between 3PLs.

A recent concept in supply chain management is the emergence of fourth party logistics specialists or *4PLs*. Sometimes referred to as the *'lead logistics provider'*, a 4PL is contracted by the shipper (such as a manufacturer or retailer) to manage the entire supply chain on its behalf (potentially including inbound flows from suppliers too). In addition to undertaking some of the supply chain logistics operations itself, the 4PL will 'buy-in' (sub-contract) other specialist logistics activities where relevant from 3PLs such as final deliveries to end-user consumers or distribution centre management. The 4PL will then co-ordinate the various activities along the supply chain, including those of contracted 3PLs, to ensure it operates efficiently.

A series of case studies below illustrates how different types of 3PLs are able to facilitate load sharing of cargo.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: DHL

DHL is a very large multi-national 3PL. It was founded in the United States of America in 1969, and since 2002 has been a wholly owned subsidiary of the German postage and parcels operator *Deutsche Post*. It began life as an international door-to-door express delivery service, focusing on small packages and documents. Through a series of expansions, mergers and acquisitions, it has developed into a large-scale 3PL which provides the full range of logistics services. Currently, it operates in 220 countries or territories and employs direct around 380,000 people.

DHL has five main operating divisions:

(i) DHL Express – an international express parcels and packages provider, aimed at the Business-to-Business market i.e. frequent volume shippers. DHL Express provides high-speed day-definite and time-definite deliveries for parcels and packages on a door-to-door basis. Much of the volume is handled through its own 'in-house' fleet of aircraft operating from major hub airports such as Leipzig, Frankfurt-am-Main and East Midlands, though some packages are also dispatched on scheduled passenger flights (in the aircraft bellyhold). It operates a 'hub and spoke' distribution system broadly following logistics Model 4. Local collection road vehicles will collect packages from clients (on a multi-collection basis) before being moved by road haulage to a hub airport. Packages are then flown between the main hub airports, before local delivery road vehicles provide final delivery to the cargo receivers (multi-drop). It is effectively a form of passive collaboration in that multiple shippers' cargo is consolidated and shares transport capacity.

(ii) DHL Parcels – an international express parcels and packages provider, aimed at the Business-to-consumer and consumer markets. Operates along similar lines to the DHL Express operations, sharing vehicle and aircraft capacity.

(iii) DHL Global Forwarding – formerly known as Danzas, this division is DHL's air and ocean freight forwarding business. Freight forwarders are organisations which manage the international transport of cargo from shippers to end-users, normally on a multi-modal basis. They will book slots on international shipping services or air services (freight and passenger bellyholds) alongside arranging the transport of cargo from the shipper to the export ports/airports and then the final transport (from the import ports/airports) to end-users.

(iv) DHL Freight – provides road and rail freight services across Europe, North Africa and the Middle East to shippers. It includes a full road transport offer, including full-load, part-load and temperature controlled operations on a door-to-door basis, primarily using their own in-house fleet of road goods vehicles. Internal collaboration (consolidating loads from multiple clients to ensure vehicle fill in both directions) and capacity sharing with other hauliers (either sub-contracting loads to other hauliers or conveying cargo for other hauliers) will be undertaken. In most cases, road and rail freight services are provided under medium-long term contracts with shippers (at agreed rates) though ad-hoc shipments are also feasible. This division will therefore have a role to play in providing transport within all the identified logistics Models. This division also provides road and rail transport services for its Global Forwarding Division (above) and the DHL Supply Chain division (below).

(v) DHL Supply Chain – manages complete supply chains on behalf of manufacturers and retailers, including transport operations integrated with warehouse and distribution centre management services and other added value activities. Where feasible or permitted by clients, transport and warehouse capacity will be shared with other customer's cargo.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Hermes

Hermes is a multi-national logistics and out-sourcing company headquartered in Hamburg, Germany. In Great Britain, Hermes specialises in the e-commerce sector, in particular the delivery of individual clothing and footwear consignments from retailer distribution centres to residential properties (business-to-consumer or B2C). The company currently handles around 245 million parcels each year through a network of 10,000 couriers. Clients include:

- Next Directory;
- ASOS;
- Tesco;
- John Lewis;
- Debenhams; and
- Arcadia Group.

Hermes' British operation broadly follows logistics Model 4 (Annex 1); effectively a 'hub and spoke' distribution system. Road freight vehicles collect consignments of cargo from shippers (generally large volumes of small individual packages of clothing or footwear from e-commerce retailers), and delivers them into one of Hermes' distribution 'hubs'. These are located close to major urban areas or strategically placed close to client distribution facilities. Locations for Hermes major 'hubs' include Warrington and Rugby. Once delivered into the 'hub', the collected cargo (from multiple shippers) is then sorted and subsequently loaded onto appropriate freight vehicles for trunking to the other hubs in close proximity to the end-user consumer. At the destination 'hub', goods will be discharged from the trunking vehicle freight vehicles, sorted and subsequently reloaded onto other freight vehicles for delivery to the next stage in the supply chain. In Hermes case, this is a network of locally based couriers who undertake final delivery to the end-user consumer (generally a self-employed 'driver and van' operator, responsible for providing the LGV and is paid per item delivered). The advantage of this 'network' is that it allows the consolidation of cargo from multiple shippers which can subsequently share transport capacity on the trunk hauls between 'hubs', thereby generating full vehicles in both directions.

Hermes also operates a consumer-to-consumer (C2C) parcel service (effectively in competition with the national Royal Mail postage service). Consumers deposit parcels at a network of small retail outlets, from where they are collected by Hermes collection vehicles (generally those delivering consignments to the locally based couriers). They are then fed into the same 'hub and spoke' network used for B2C deliveries (as described).

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Palletline

Palletline is a British based road haulage operation. It is a palletised cargo distribution network, specialising in the movement of single or multi-pallet consignments (i.e. less than full lorry-load delivery quantities) on a business-to-business (B2B) basis. Palletised cargo consists of goods stacked on a wooden pallet (platform), thereby enabling efficient loading/discharge from transport units using forklift truck equipment. Such operations also referred to as 'groupage' or 'spedition'.

Palletline is actually a co-operative, owned by around 70 member road hauliers spread across Great Britain. Together the member companies comprise around 6,000 goods vehicles and 12,000 employees. At a practical level, it operates a 'hub and spoke' distribution system (Model 4) similar in nature to that undertaken by Hermes (see above), whereby palletised cargo is transported via a number of strategically located 'hubs'. The 'hubs' are located at:

- Birmingham;
- Manchester;
- London;
- Rugby;
- Leicester;
- Swindon; and
- Glasgow.

Each member haulier is responsible for collecting consignments of palletised cargo from shippers in their immediate hinterland, delivering them into their own distribution depots. There, the pallets are sorted and then loaded onto the member hauliers' freight vehicles for overnight trunking to one of the palletline 'hubs' listed above. At the 'hubs', the palletised cargo is cross-docked onto other member hauliers' freight vehicles for trunking to a distribution depot close to the final end-user. Each member haulier is then responsible for the final delivery in their immediate hinterland. Palletline provides a central co-ordinating role alongside operating the 'hubs'. Palletline is therefore a formal collaboration arrangement whereby the member hauliers agree to transport each other's contracted cargo, and in doing so this reduces empty running and ensures vehicle fill on the longer distance trips to/from the 'hubs'.

The palletline network is therefore attractive to shippers despatching goods in less than full-HGV load quantities in one move (such as single or few pallets of cargo). By consolidating the collected cargo at a member haulier's depot, it generates sufficient volumes of cargo (critical mass) to enable the long distance trunking operation to/from the hubs to be undertaken in fully loaded HGVs.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Freightliner Intermodal

Freightliner is a British based rail freight operator. Owned by Brookfield, a global asset management fund, Freightliner is divided into two main divisions:

- Freightliner Heavy Haul – the transport by rail of bulk commodities, such as aggregates, in full train-load volumes; and
- Freightliner Intermodal – the transport of deep-sea maritime shipping containers by rail.

Freightliner Intermodal operates intermodal freight trains between the deep-sea container ports of Felixstowe, London Gateway and Southampton and the following inland terminals:

- Teesside (Middlesbrough);
- Leeds;
- Manchester (Trafford Park);
- Birmingham;
- Doncaster;
- Widnes (Ditton);
- Liverpool;
- Glasgow (Coatbridge);
- Bristol; and
- Cardiff.

The inland terminals are strategically located close to manufacturing and large scale distribution centres serving the retail market. Freightliner's intermodal trains are operated on a liner model basis. Similar to passenger trains, they operate scheduled daily trains between the three ports and the inland terminals listed. Effectively, deep-sea shipping lines and freight forwarders purchase container 'slots' on these services. Freightliner can also provide 'last mile' delivery (by road transport) between the inland terminal sites and the end-user (or from the shipper in the case of export flows). This operating model effectively allows shipping lines and freight forwarders to share intermodal capacity between the ports and key inland end-users.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

It is also important to appreciate that most organisations which despatch cargo (shippers) do so frequently (i.e. at least 5 days per week if not every day) and in sizeable volumes. It is not, therefore, a one-off event or an after-thought. Given this position, shippers will already have commercial arrangements in place to ensure that cargo is delivered to the next stage of the supply chain in a timely manner, and to maximise service levels and cost efficiency. These commercial arrangements are likely to include vertical relationships with contracted 3PLs and, as noted, their effective 'day job' is to consolidate cargo from multiple shippers to ensure that transport and storage capacity is utilised efficiently. Commercial arrangements would normally be kept under regular review. In addition, shippers may also be actively collaborating with other shippers.

Collaboration is therefore already happening on a daily basis as part of shippers and 3PLs normal day-to-day operations. The LOGISTAR tool will therefore need to be able to enhance what is already standard business practice in the logistics arena.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

3. Assessing Opportunities for LOGISTAR

This section of the report examines in more detail some of the individual flows/links within the main logistics supply chain models that have been adopted by both the retail and manufacturing sectors. It addresses the extent to which collaboration already occurs, alongside identifying where there is potential for further collaboration. It also identifies where there are likely to be opportunities for collaboration where such currently does not exist.

3.1. Suppliers and Manufacturers to NDC/RDC Flows

This sub-section focuses on supply chain logistics *Models 1, 2 and 3*, and within these models flows of goods from manufacturers/suppliers to retailer *National Distribution Centres (NDCs)* and *Regional Distribution Centres (RDCs)*. Given that it is now common practice for retailers and manufacturers to out-source much of their transport and other logistics functions to 3PLs (and the restrictions placed on own account operations limiting collaboration), the discussion below assumes that in each case the cargo flows are undertaken by 3PLs.

Referring to Figure 4 below, flow *diagram A* illustrates the basic concept. Out-sourced to a 3PL and using road haulage, goods will move from a supplier to a NDC or RDC (ideally fully laden but possibly partially laden). In this case, the supplier could be a factory, a manufacturer's storage facility or a port (e.g. maritime container stacked on the quay). Once the goods are successfully delivered to the NDC/RDC, the road haulage vehicle will re-position empty back to the supplier. There may, of course, be good reasons why the road vehicle will return empty. For example, the distances involved may be very short. On the other hand, the 3PL may assume that there are no suitable backloads available in proximity to the NDC/RDC, and hence they simply re-position the vehicle empty.

Flow *diagram B* (Figure 4) illustrates what should (and does) happen in an ideal scenario. Once the goods (full load) are successfully delivered to the NDC/RDC (as per diagram A), the 3PL's road haulage vehicle re-positions empty over a short distance and collects a backload from another shipper, before transporting it to a receiver in close proximity to the original supplier. The 3PL may already have a contract to undertake road transport on behalf of the other shipper (in which case, internally the 3PL is optimising use of its own transport fleet). Alternatively, the 3PL may undertake the movement as a sub-contracted load from the shipper's own 3PL. This would therefore appear to be an opportunity for the LOGISTAR digital tool, in that an available cargo load and empty vehicle capacity could be matched in real time.

Flow *diagram C* (Figure 4) illustrates what should (and does) happen, in an ideal scenario, when the volume of cargo to be delivered to the NDC/RDC from the supplier is less than the road vehicle's capacity. In this case, the contracted 3PL would consolidate the part-load with another part-load, also destined for the NDC/RDC, but from a shipper in close proximity (thereby creating a full-load into the NDC/RDC). Again, the 3PL may already have a contract to undertake road transport on behalf of the other shipper (in which case, internally the 3PL is optimising use of its own transport fleet). Alternatively, the 3PL may undertake the movement as a sub-contracted load from the shipper's own 3PL. This would appear to be an opportunity for the LOGISTAR digital tool to enable matching in real time of an available cargo load with empty vehicle capacity.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Flow *diagram D* (Figure 4) shows the same supplier to NDC/RDC flow but instead undertaken using intermodal transport (intermodal unit using road and rail freight), and out-sourced to a 3PL. In this case, the intermodal unit (containing the goods) would initially be moved by road from the supplier to an intermodal terminal for loading to rail. Again, the supplier could be a factory, a manufacturer's storage facility or a port (and ideally located on the same site at the supplier, thereby minimising the road element of the flow). At the NDC/RDC end of the trip, the goods would be lifted from rail at another intermodal terminal and transported to the NDC/RDC (again, ideally located on the same site as the supplier, thereby minimising the road haul). Once the goods are successfully delivered to the NDC/RDC, the empty intermodal unit will re-position empty back to the supplier via the same route.

Flow *diagram E* (Figure 4) illustrates what should (and does) happen in an ideal scenario. Once the goods are successfully delivered to the NDC/RDC (as per diagram D), the 3PL would re-position the empty intermodal unit over a short distance and collect a backload from another shipper, before transporting it to a receiver in close proximity to the original supplier, returning via the same intermodal terminal. Again, the 3PL may already have a contract to undertake transport on behalf of the other shipper (in which case, internally the 3PL is optimising use of its own transport fleet). Alternatively, the 3PL may undertake the movement as a sub-contracted load from the shipper's own 3PL. As per the road based flows, this would appear to be an opportunity for the LOGISTAR digital tool, in that an available cargo load and empty intermodal capacity could be matched in real time.

Where the volume of cargo is less than a full load, the supplier could utilise the services of a shared user network (such as Palletline)[1]. This is illustrated in flow *diagram F* (Figure 4). The cargo would initially be collected by road haulage, and then pass through the operator's hubs and trunking network, before being delivered to the NDC/RDC on a multi-drop basis. This might be an opportunity for the LOGISTAR digital tool to match an available cargo load and spare vehicle capacity in real time.

[1] Also referred to as 'groupage' or 'spedition'

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

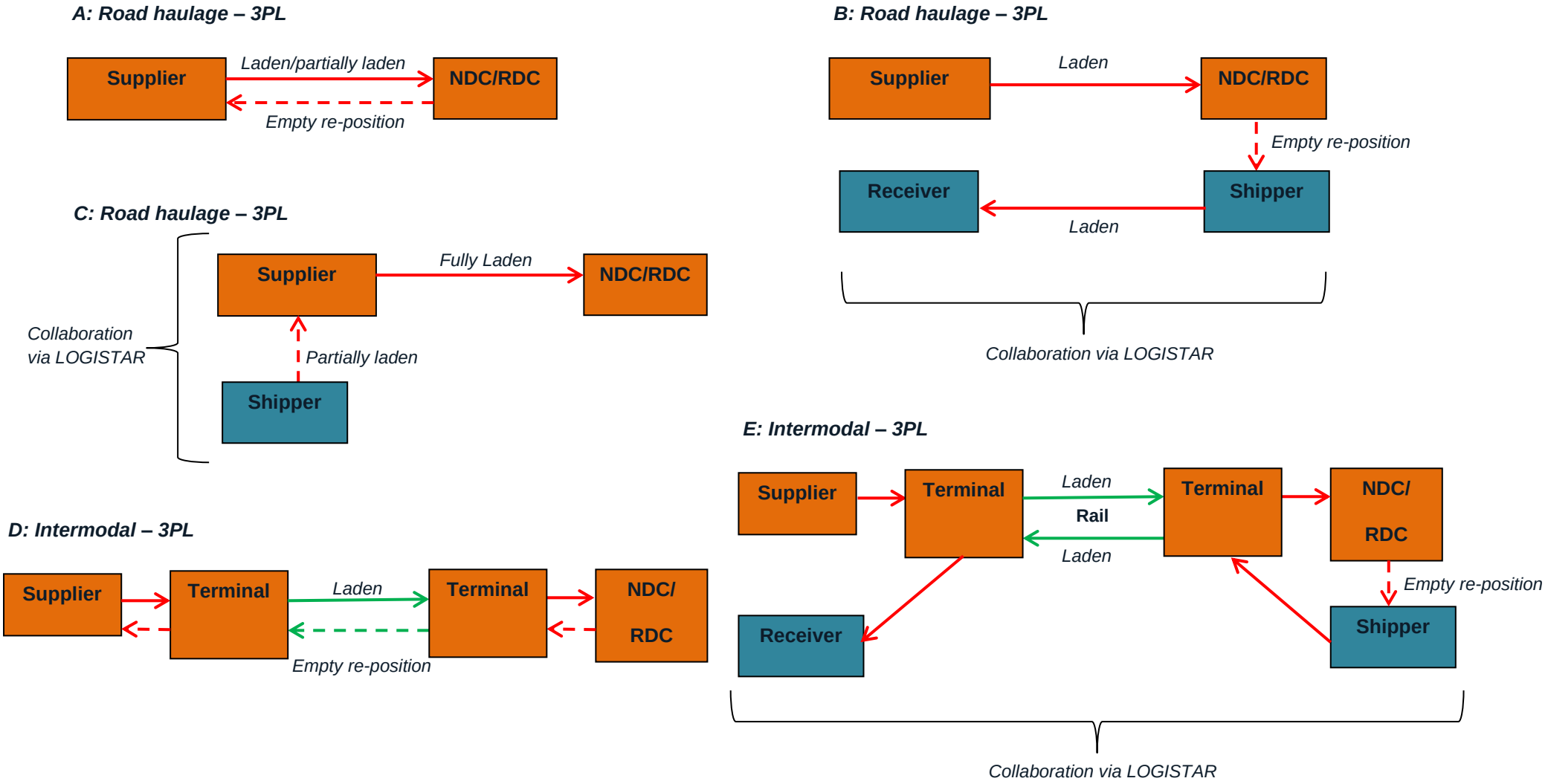

Figure 4 Supplier (Manufacturer) to NDC/RDC Flows

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

F: Road haulage – Shared User 3PL (Palletline) Network

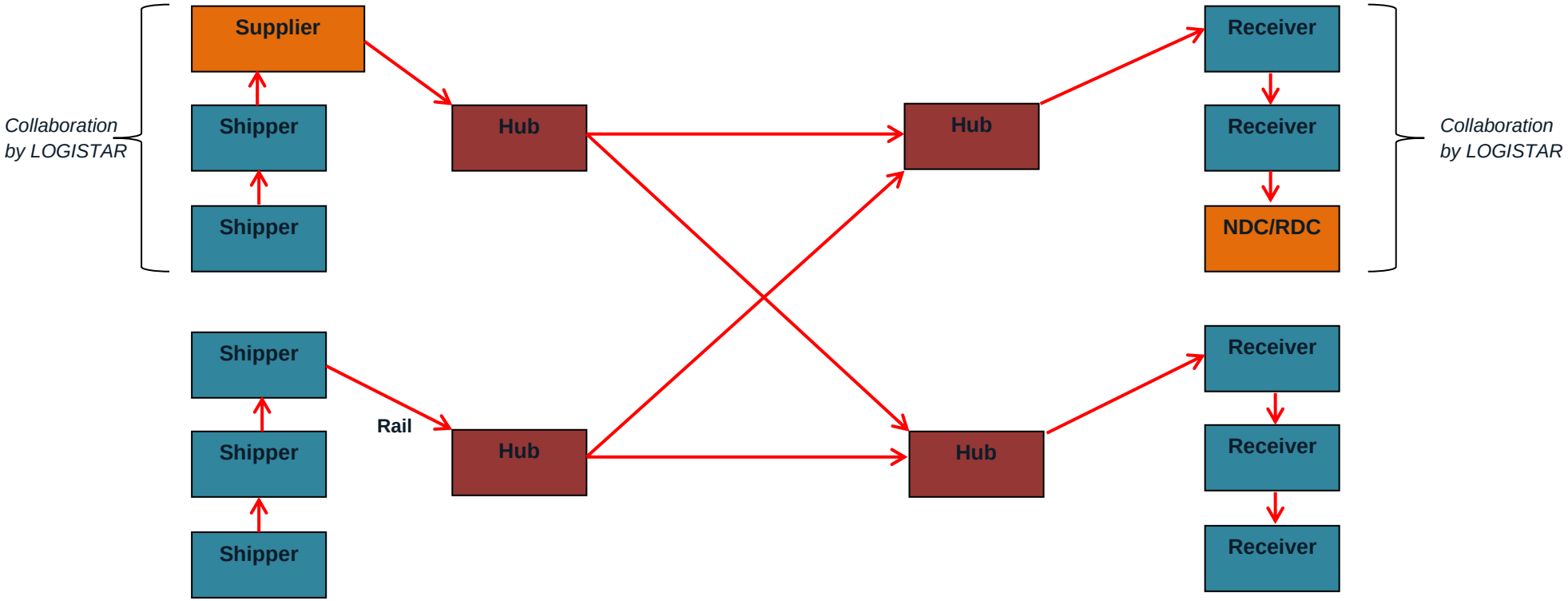

Figure 4 Continued:Supplier (Manufacturer) to NDC/RDC Flows

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Kellogg's

Breakfast cereal and convenience food manufacturer Kellogg's has two main manufacturing plants in Great Britain, located at Trafford Park (Manchester) and Wrexham (North Wales). In addition to manufacturing breakfast cereals, the Trafford Park site also hosts the company's central storage and distribution warehouse for Great Britain and Ireland. Products produced at the Wrexham facility are in the first instance transported to Trafford Park where they are consolidated and stored alongside the breakfast cereals produced at that site. From Trafford Park, the combined goods are subsequently distributed (generally in full HGV loads) to the RDCs of the major grocery retailers and convenience store suppliers across Great Britain and Ireland.

The internal movements of product from Wrexham to Trafford Park and outbound flows from Trafford Park (to RDCs) is contracted to a 3PL, *Harlequin Logistics*. Harlequin Logistics is a consortium of road haulier based 3PLs Currie Solutions, John Raymond Transport, Jack Richards and Prestons of Potto. The combined operation consists of around 2,000 trailer units based at 23 depots across Great Britain (see map below). This collaborative network therefore allows north west based HGVs to depart Trafford Park fully loaded, and subsequently collect backloads from other depots in the consortium (contracts with other shippers) and return back to the north west of England loaded. Likewise, HGVs based in other regions delivering into the north west for other shippers can collect goods from Kellogg's as a backload. Further, where any outbound movements from Kellogg's are less than full-load, these can be consolidated with other contracted cargo Harlequin transports to generate a full-HGV

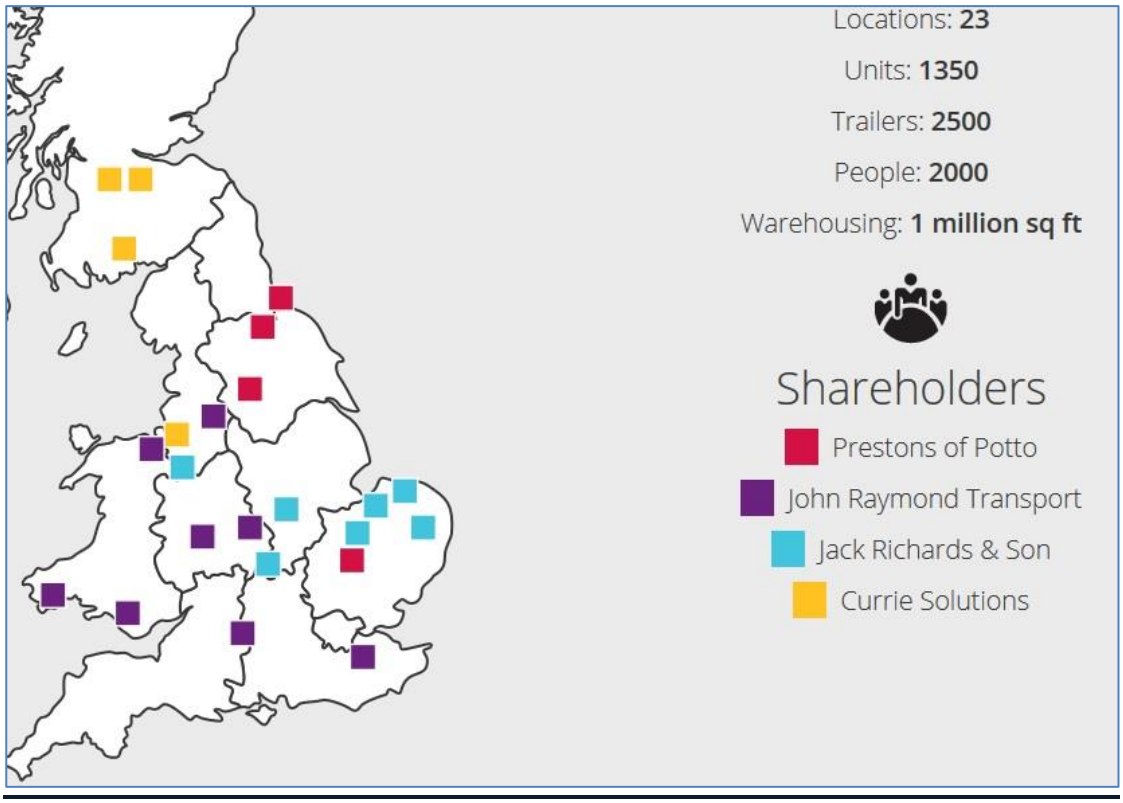

Figure 5 Harlequin Logistics Network

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Heinz

International food manufacturer Heinz has two main production plants in western Europe; at Wigan in north west England and at Elst in the Netherlands. Wigan is the main production site for canned products (such as baked beans, soups etc..), producing for both the British, Irish and mainland European markets. The Netherlands site produces bottled sauces and other pre-prepared foodstuffs, some of which are imported to Great Britain. The Wigan site also hosts the company's central storage and distribution warehouse for Great Britain and Ireland, holding products manufactured at Wigan and those imported from the Netherlands.

Transport movements in Great Britain are contracted to 3PL *Wincanton*. Exports from Wigan to mainland Europe and imports from the Netherlands to Wigan both pass via the Humber estuary. Using a drop-trailer system, Wincanton hauls fully loaded trailers from Wigan to the Humber estuary for export, depositing them at the quay prior to loading onto RoRo vessels destined for the Netherlands. The same HGV will then collect an imported drop-trailer (recently arrived from the Netherlands) from the quayside containing the Dutch manufactured products. These are subsequently hauled back to Wigan for storage at the central storage warehouse (alongside Wigan produced canned products). HGVs therefore run fully loaded in both directions.

Outbound flows from Wigan to the RDCs of the major grocery retailers and convenience store suppliers across Great Britain and Ireland are undertaken via Wincanton's domestic fleet network. Wincanton's Wigan based HGVs depart fully loaded, and subsequently collect backloads from other company depots (contracts with other shippers) and return back to the north west of England fully loaded. Likewise, HGVs based in other regions delivering into the north west for other shippers can collect goods from Wigan as a backload.

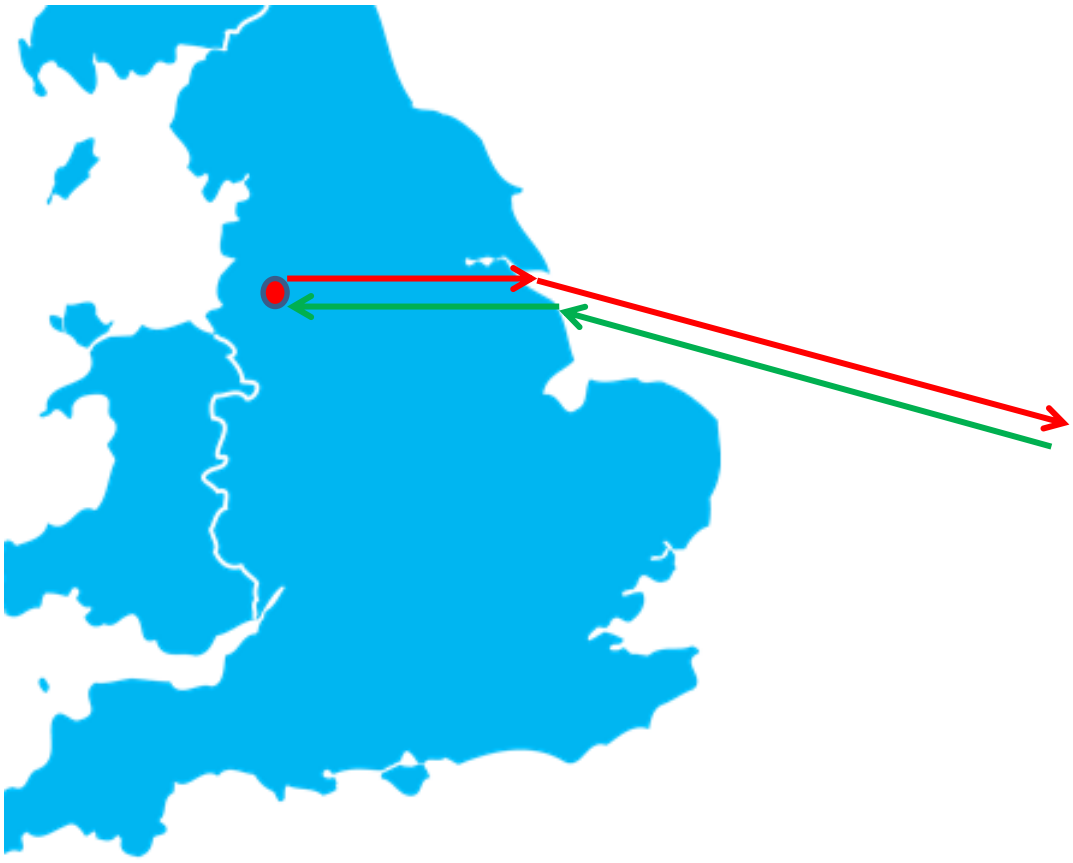

Figure 6 Heinz flows Wigan (GB)-Elst (Netherlands)

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Maritime Transport

Maritime Transport were originally a specialist container road haulier. In recent years they have diversified into a mainstream 3PL operator, including curtain-sided semi-trailer distribution and warehouse management for major suppliers and retailers, though they continue to own the largest container road transport fleet in Great Britain. In January this year, Maritime Transport and rail freight operator *DB Cargo* announced they had agreed a new long-term commercial arrangement. In practice, Maritime Transport (via a new subsidiary called Maritime Intermodal) will now distribute maritime containers on a multi-modal basis from the deep-sea container ports of Felixstowe, London Gateway, Tilbury and Southampton.

Maritime currently operates the BIFT terminal at Birch Coppice (near Birmingham) and have also recently been awarded the contract to operate the new intermodal terminal at East Midlands Gateway (near Derby and Nottingham). The DB Cargo arrangement also includes the acquisition of DB Cargo's Trafford Park and Wakefield (near Leeds) terminals. Maritime therefore now operates four inland terminals serving the East and West Midlands, North West and Yorkshire/Humber. Over the next few years, Maritime Intermodal plans to add further intermodal rail services to this terminal network.

Similar to passenger services, Maritime's trains between the listed ports and inland terminals will operate on a scheduled daily basis. Maritime will effectively consolidate container volumes from multiple deep-sea shipping lines and freight forwarders onto these services. Maritime can also provide 'last mile' delivery (by road transport) between the inland terminal sites and the end-user (or from the shipper in the case of export flows). This operating model effectively allows shipping lines and freight forwarders to share intermodal capacity between the ports and key inland end-users.

Maritime also optimises the use of its own road fleet by switching HGVs between its maritime container operations and general distribution and warehouse contracts as demand dictates.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

3.2. NDC to RDC/Cross Dock Flows

This sub-section focuses on supply chain logistics *Models 2 and 3*, and within these models the flows of goods from retailer NDCs to RDCs or 'Cross Dock' facilities[2]. Again, given that it is now common practice for retailers and manufacturers to out-source much of their transport and other logistics functions to 3PLs (and the restrictions placed on own account operations limiting collaboration), the discussion below assumes that in each case the cargo flows are undertaken by 3PLs.

Referring to Figure 7 below, flow *diagram A* illustrates the basic concept. Out-sourced to a 3PL and using road haulage, goods will move from a retailer's NDC to a series of RDCs (ideally fully laden but possibly partially laden). Once the goods are successfully delivered to the RDCs, the road haulage vehicles will re-position empty back to the NDC.

Flow *diagram B* (Figure 7) illustrates what should (and does) happen in an ideal scenario. Once the goods (full load) are successfully delivered to the RDCs (as per diagram A), the 3PL's road haulage vehicles will re-position empty over a short distance and collect backloads from other shippers, before transporting them to receivers in close proximity to the NDC. As per above, the 3PL may already have a contract to undertake road transport on behalf of the other shippers (in which case, internally the 3PL is optimising use of its own transport fleet). Alternatively, the 3PL may undertake the movements as a sub-contracted load from the shippers' own 3PLs. This would therefore appear to be an opportunity for the LOGISTAR digital tool, in that an available cargo load and empty vehicle capacity could be matched in real time.

Flow *diagram C* (Figure 7) illustrates what should (and does) happen in an ideal scenario, when the volume of cargo to be delivered to RDCs from the NDC is less than the road vehicle's capacity. In this case, the contracted 3PL would consolidate the part-loads with other part-loads, also destined for the RDCs, but from other shippers in close proximity (thereby creating a full-load into the RDCs). Again, the 3PL may already have a contract to undertake road transport on behalf of the other shippers (in which case, internally the 3PL is optimising use of its own transport fleet). Alternatively, the 3PL may undertake the movement as a sub-contracted load from the shippers' own 3PLs. This would appear to be an opportunity for the LOGISTAR digital tool, in that an available cargo load and empty vehicle capacity could be matched in real time.

Flow *diagram D* (Figure 7) shows the same NDC to RDC flows but instead undertaken using intermodal transport (intermodal unit using road and rail freight), and out-sourced to a 3PL. In this case, the intermodal unit (containing the goods) would initially be moved by road from the NDC to an intermodal terminal for loading to rail. At the RDC end of the trip, the goods would be lifted from rail at another intermodal terminal and transported to the RDC (again, ideally located on the same site as the supplier, thereby minimising the road haul). Once the goods are successfully delivered to the RDC, the empty intermodal unit will re-position empty back to the NDC via the same route.

[2] A cross-docking facility is superficially similar to a warehouse but is designed primarily for transferring cargo between freight vehicles in short periods of time, often a few hours. No storage or other fulfilment activities are undertaken.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Flow *diagram E* (Figure 7) illustrates what should (and does) happen in an ideal scenario. Once the goods are successfully delivered to the RDC (as per diagram D), the 3PL would re-position the empty intermodal unit over a short distance and collect a backload from another shipper, before transporting it to a receiver in close proximity to the NDC, returning via the same intermodal terminal. Again, the 3PL may already have a contract to undertake transport on behalf of the other shipper (in which case, internally the 3PL is optimising use of its own transport fleet). Alternatively, the 3PL may undertake the movement as a sub-contracted load from the shipper's own 3PL. As per the road based flows, this would appear to be an opportunity for the LOGISTAR digital tool, in that an available cargo load and empty intermodal capacity could be matched in real time.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

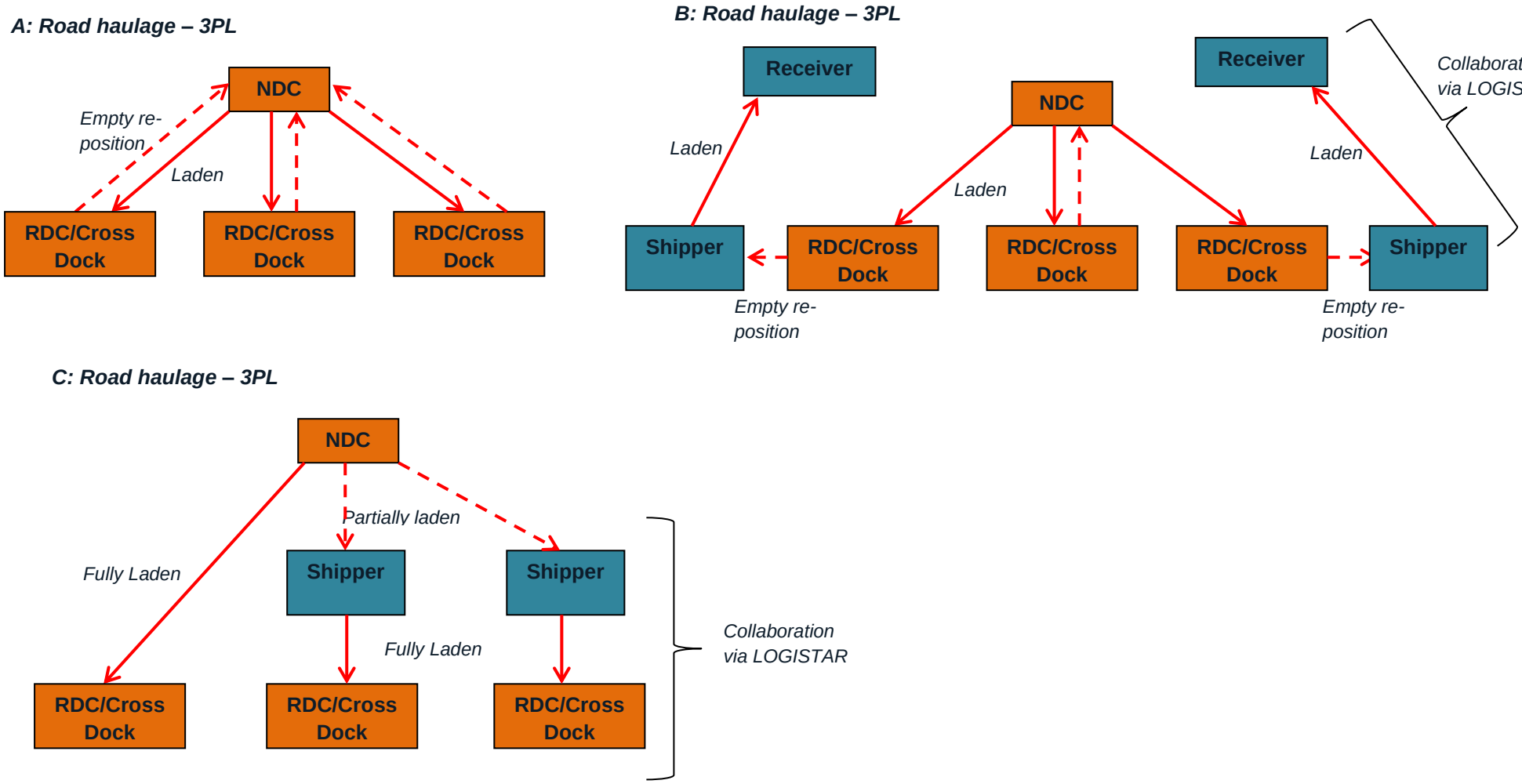

Figure 7 NDC to RDC/Cross Dock Flows

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

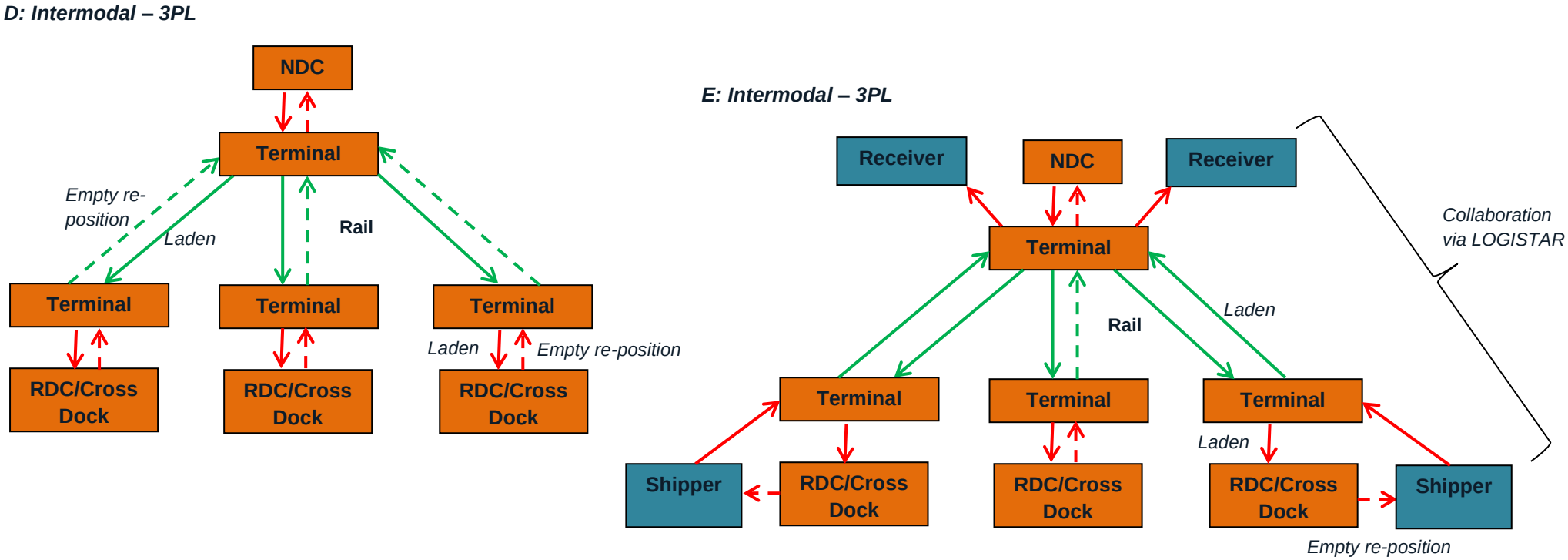

Figure 7 Continued NDC to RDC/Cross Dock Flows

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Tesco

Tesco is the largest grocery retailer in Great Britain. It currently operates just under 3,500 stores, ranging from large 'out of town' hypermarket outlets through to smaller urban-based convenience stores under the 'Express' and 'Metro' brands. It also undertakes e-commerce ordered deliveries direct to residential properties; these are mainly picked from large stores and delivered direct to residential properties in light vans. Its supply chain broadly follows Logistics Model 3 – Bricks & Mortar plus E-Commerce from Store Retailer. To service this network of stores, Tesco operates a large NDC located at the rail-served Daventry International Rail Freight Terminal (DIRFT) site near Northampton, alongside a series of RDCs close to the main urban conurbations. The RDCs are shown on the map below.

Figure 8 Tesco RDC Network

The DIRFT NDC holds slower moving lines plus seasonal goods (generally with longer lead times), originating from both overseas and domestic suppliers. The RDCs receive, direct from suppliers, faster moving and time sensitive cargoes (such as fresh produce). When ready for delivery to store, goods held at the DIRFT NDC are moved to the RDCs, where they are consolidated with goods held at the RDC before re-distribution to stores.

Trunking movements from the NDC to the RDCs are undertaken by 3PL *Stobart*. Interestingly, flows to the Livingston, Dagenham and Monmouth RDCs are undertaken by intermodal rail freight from DIRFT (in partnership with rail operator DRS), using nearby intermodal terminals. Stobart then use the return rail operation back to DIRFT to convey inbound goods to the NDC from Tesco's domestic suppliers. The remainder of the NDC to RDC trunking operation is undertaken using Stobart's pooled HGV fleet. Consequently, DIRFT based HGVs depart fully loaded, and subsequently collect backloads from other shippers (contracts with other shippers) and return back to the East Midlands fully loaded. Likewise, HGVs based in other regions delivering into the DIRFT area for other shippers collect goods from the NDC as a backload.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Case Study: Ocado

Ocado is an e-commerce only grocery retailer in Great Britain. Its supply chain broadly follows Logistics Model 2 – E-Commerce Supply Chain 2.

Ocado operates a number of central 'warehouses' called customer fulfilment centres (CFCs). These are located at:

- Hatfield (Hertfordshire);
- Erith (London);
- Andover (Hampshire); and
- Tamworth (Staffordshire).

Each CFC receives goods direct from suppliers. On-line orders received by the retailer are picked, and packed into customer-specific crates. These crates are then subsequently loaded onto freight vehicles for trunking to a series of regional cross-dock facilities located close to major conurbations. The cross-docks are located at:

- Leeds
- Liverpool (Knowsley)
- Manchester
- Sheffield
- Oxford
- Bristol
- Southampton
- London (7 sites around the capital).

The cross-docking facilities are superficially similar to a warehouse but are designed primarily for transferring cargo between freight vehicles i.e. no storage or other fulfilment activities are undertaken. Ocado undertake the CFC-cross-dock trunking operations in-house using their own fleet of HGVs. At the cross-docking facility, the customers' crates are off-loaded from the HGVs and re-loaded onto light vans for delivery to residential properties on a multi-drop (milk-round) basis. The return cross-dock to CFC HGV movements are used to re-position the empty crates back to the CFCs following receipt of goods by the customers.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

3.3. NDCs to Consumers Direct

Alternatively, the supplier could utilise the services of parcel network (such as Hermes) in order to transport consignments direct from NDCs to consumers. This is illustrated in flow *diagram A* (Figure 9). The cargo would initially be collected by road haulage (perhaps on a multi-collection basis), and then pass through the parcel operator's cross docking hubs and into its trunking network. It would then be delivered into another cross docking hub before being delivered to the DC/RDC on a multi-drop basis. This might be an opportunity for the LOGISTAR digital tool, in that an available cargo load and spare vehicle capacity could be matched in real time.

Case Study: Next

Next is large clothing retailer in Great Britain. It currently operates around 550 stores. It also has an e-commerce offer marketed under the 'Next Directory' brand. Its supply chain broadly is a combination of Logistics Model 2 (E-Commerce 2) and Logistics Model 3 – Bricks & Mortar.

To service this network of stores, Next operates a series of NDCs located at Pontefract, Rotherham and Doncaster, alongside a series of RDCs close to the main urban conurbations. In general, retail-outlet goods move from the NDCs to the RDCs and subsequently to stores when required. However, unlike Tesco and other grocery retailers, Next Directory orders are stored, picked, packaged and despatched direct to residential properties from their Pontefract NDC. For this part of the operation, Next have contracted parcel operator *Hermes*. Goods departing the Pontefract NDC therefore enter Hermes shared user network, as described in the Case Study further above.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

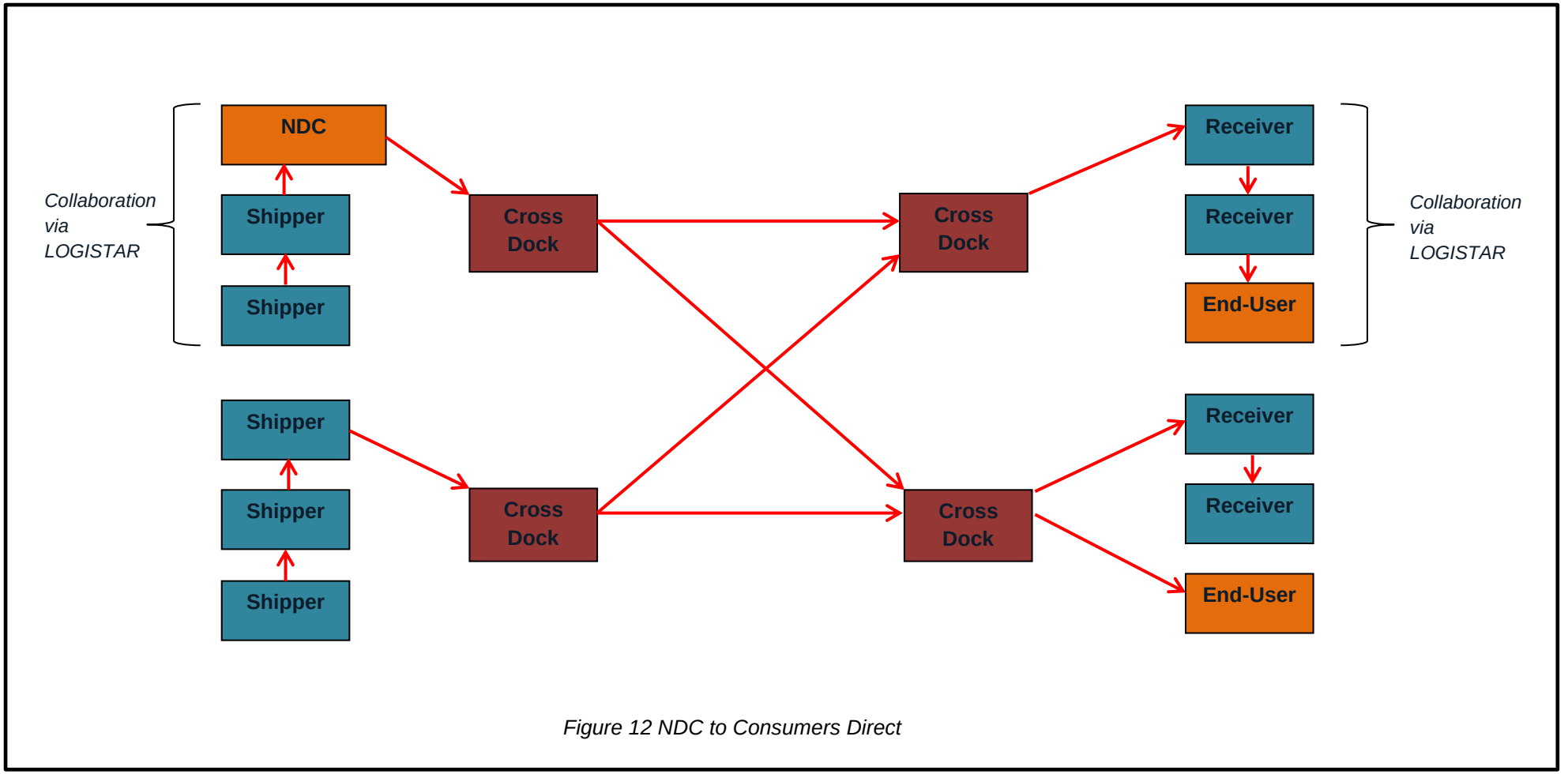

Figure 12 NDC to Consumers Direct

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

4. Conclusions and Next Steps

This written report presents the first Task 8.3 annual update. Building on the information and conclusions contained in the initial report, the analysis:

1. Examines in more detail some of the flows/links within the main logistics supply chain models that have been adopted by both the retail and manufacturing sectors. It identifies the key commercial players involved and how they operate. It addresses the extent to which collaboration already occurs, alongside identifying where there is potential for further collaboration. It also identifies where there are likely to be opportunities for collaboration where it currently does not exist.

2. Derived from the outputs of (1) above, the report identifies where the potential market opportunities are likely to exist for the LOGISTAR 'digital tool'. This output can effectively form the starting 'input' for the exploitation and implementation plan; it will identify the key sectors and operators where LOGISTAR could have a role and hence where any marketing activity should be focused (and conversely the sectors/players not likely to be interested).

The analysis presented above includes a number of 'case studies'.

Vertical collaboration covers the process whereby companies enter into commercial relationships with companies operating at different levels of trade. In the logistics sector it is common practice as manufacturers, suppliers and retailers now out-source much of their transport and other logistics functions to specialist service providers (3PLs).

Horizontal collaboration is where companies operating at the same level of production or distribution in a market form commercial agreements. In the logistics sector, it essentially covers shippers and 3PLs sharing transport and/or storage capacity. This can be 'active collaboration' in that the shippers/3PLs will actively seek out collaborators and subsequently enter into collaborative partnerships in order to gain the economic efficiencies. For example, the case studies have shown that 3PLs will actively collaborate by sub-contracting cargo to one another (both internally and to outside 3PLs), thereby reducing empty running or ensuring vehicle fill.

While shippers do not directly set out to collaborate with others, it is often the case that goods despatched by multiple shippers (often competitors) will at some point in the supply chain end up being handled by a common 3PL operator and share the same logistics capacity (storage and/or transport). This could be termed 'passive' or 'accidental' collaboration. The process of out-sourcing logistics functions therefore facilitates (unwittingly) horizontal collaboration between multiple shippers.

A key conclusion to draw, therefore, is that while collaboration (active and passive) is already common practice, the LOGISTAR tool could find a significant role internally within existing large 3PLs, optimising the use of their transport equipment through the consolidation and load-sharing of cargoes from multiple shipper clients in real time. It could also help facilitate the further sub-contracting of cargoes between 3PLs.

Collaboration is therefore already happening on a daily basis as part of shippers and 3PLs normal day-to-day operations. However, it will be important to show that the LOGISTAR tool is able to enhance what is already standard business practice in the logistics arena.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Key areas within supply chains where there are likely to be opportunities for the LOGISTAR tool include:

- Flows of goods from manufacturers and supplier to retailer NDCs and RDCs; and
- Flows of goods from retailer NDCs to RDCs or 'Cross Dock' facilities.

It is intended that the conclusions outlined above will form the basis of an interview programme with a number of key market operators in the first half of 2020. These emerging conclusions will be 'tested' with these key players in the market.

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

List of Abbreviations and Acronyms

EU	European Union
RDC	Regional Distribution Centre
NDC	National Distribution Centre
HGV	Heavy Goods Vehicle
MGV	Medium-sized Goods Vehicle
LGV	Light Goods Vehicle
3PL	Third Party Logistics provider
4PL	Fourth Party Logistics provider
R&D	Research and Development
B2C	Business to Consumer
C2C	Consumer to Consumer
B2B	Business to Business
BIFT	Birmingham International Freight Terminal
DIRFT	Daventry International Rail Freight Terminal
DRS	Direct Rail Services
DB	Deutsche Bahn
CFC	Customer Fulfilment Centre

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

Annex 1 Logistics Business Models

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

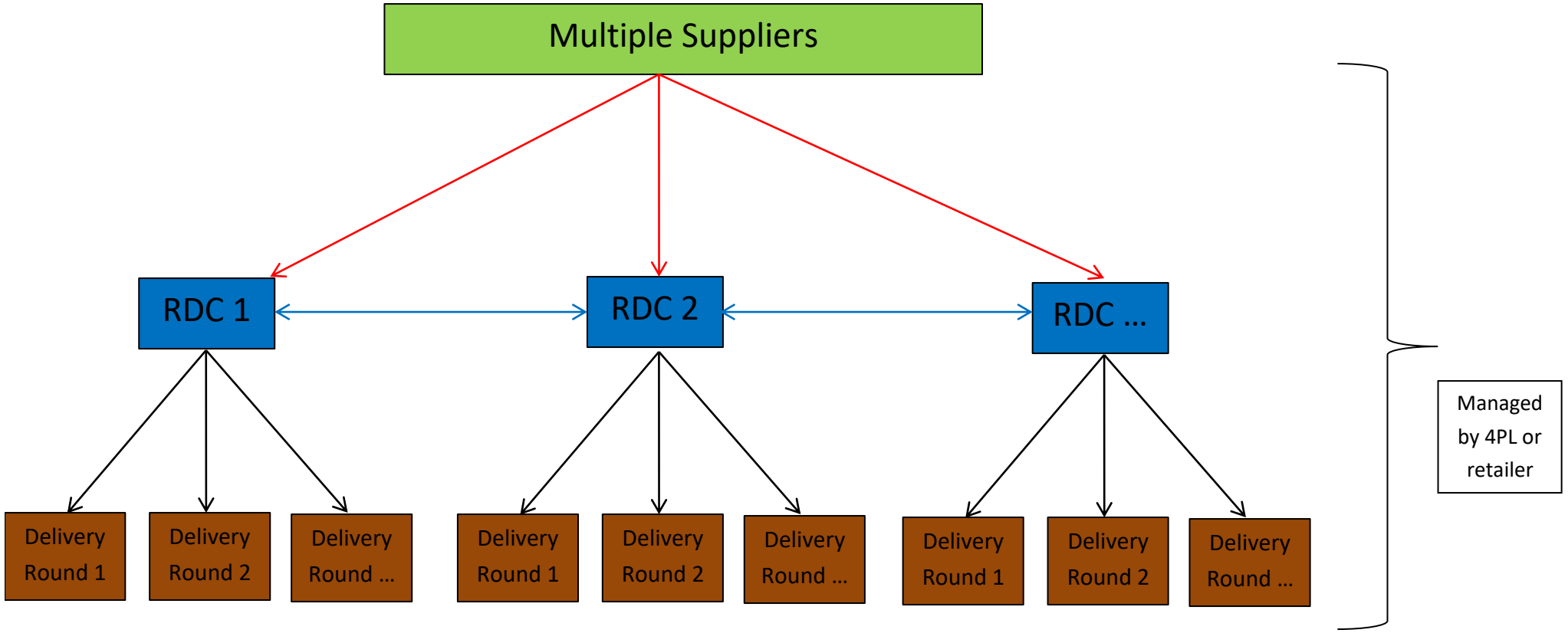

Figure A 1 Flow Diagram – E-Commerce Supply Chain 1

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

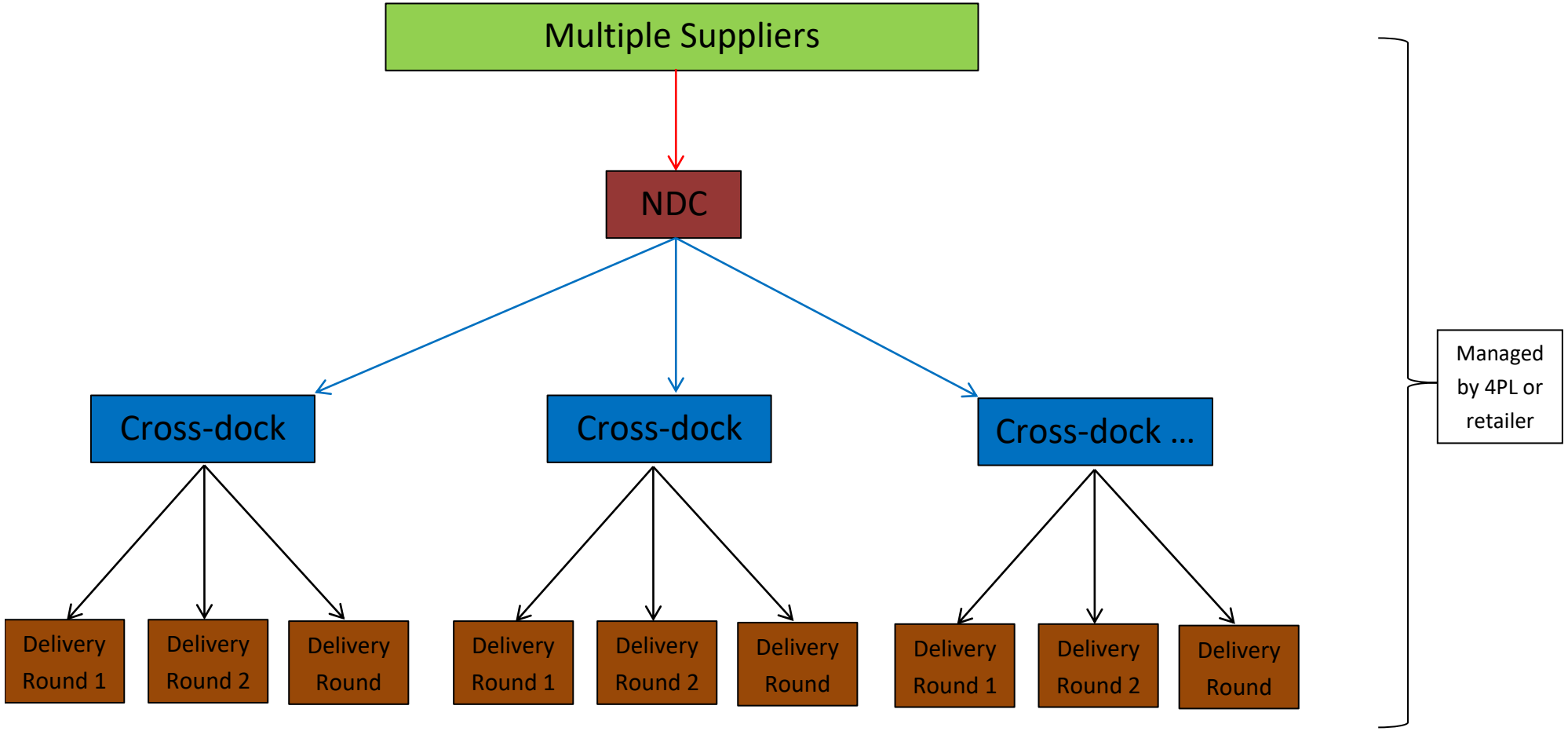

Figure A 2 Flow Diagram – E-Commerce Supply Chain 2

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

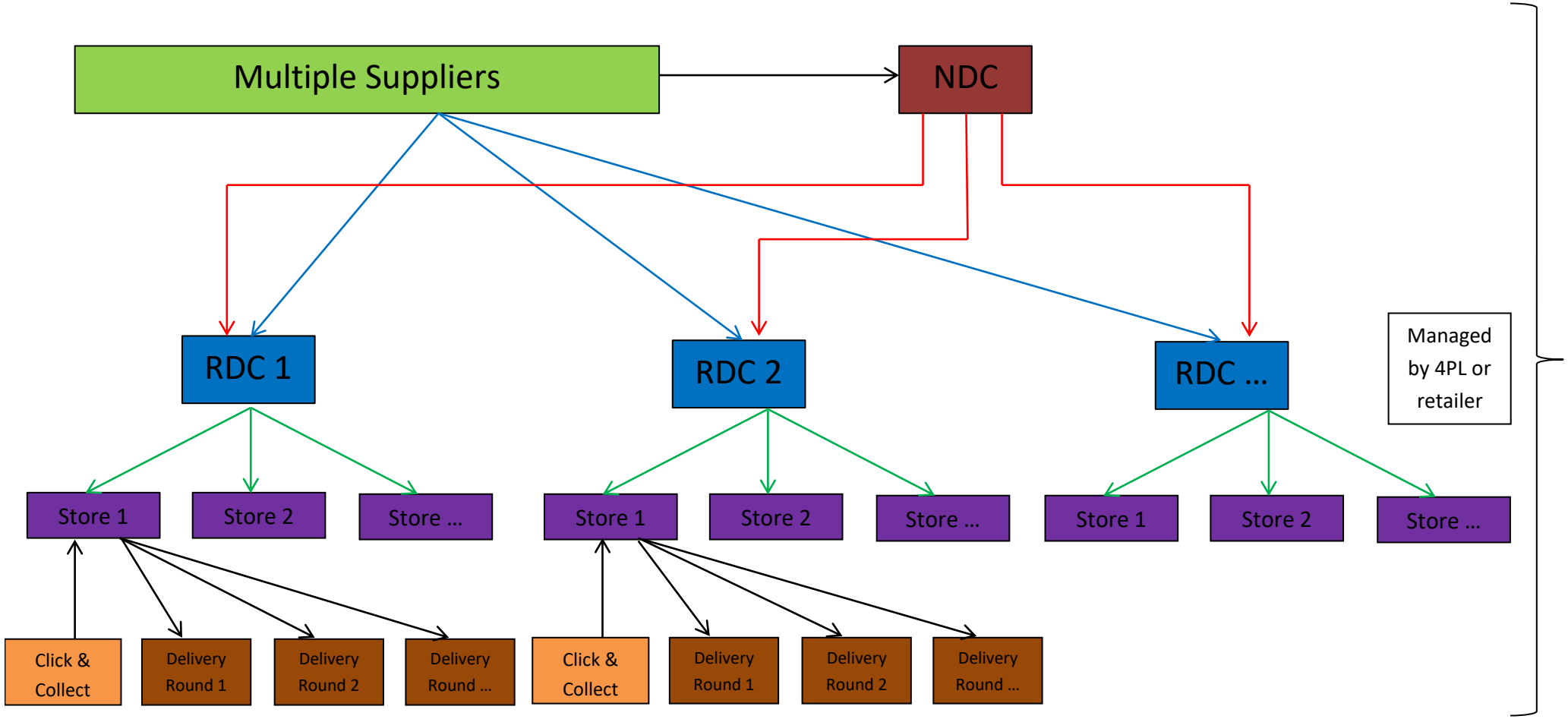

Figure A 3 Flow Diagram – Bricks & Mortar plus E-Commerce from Store Retailer

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

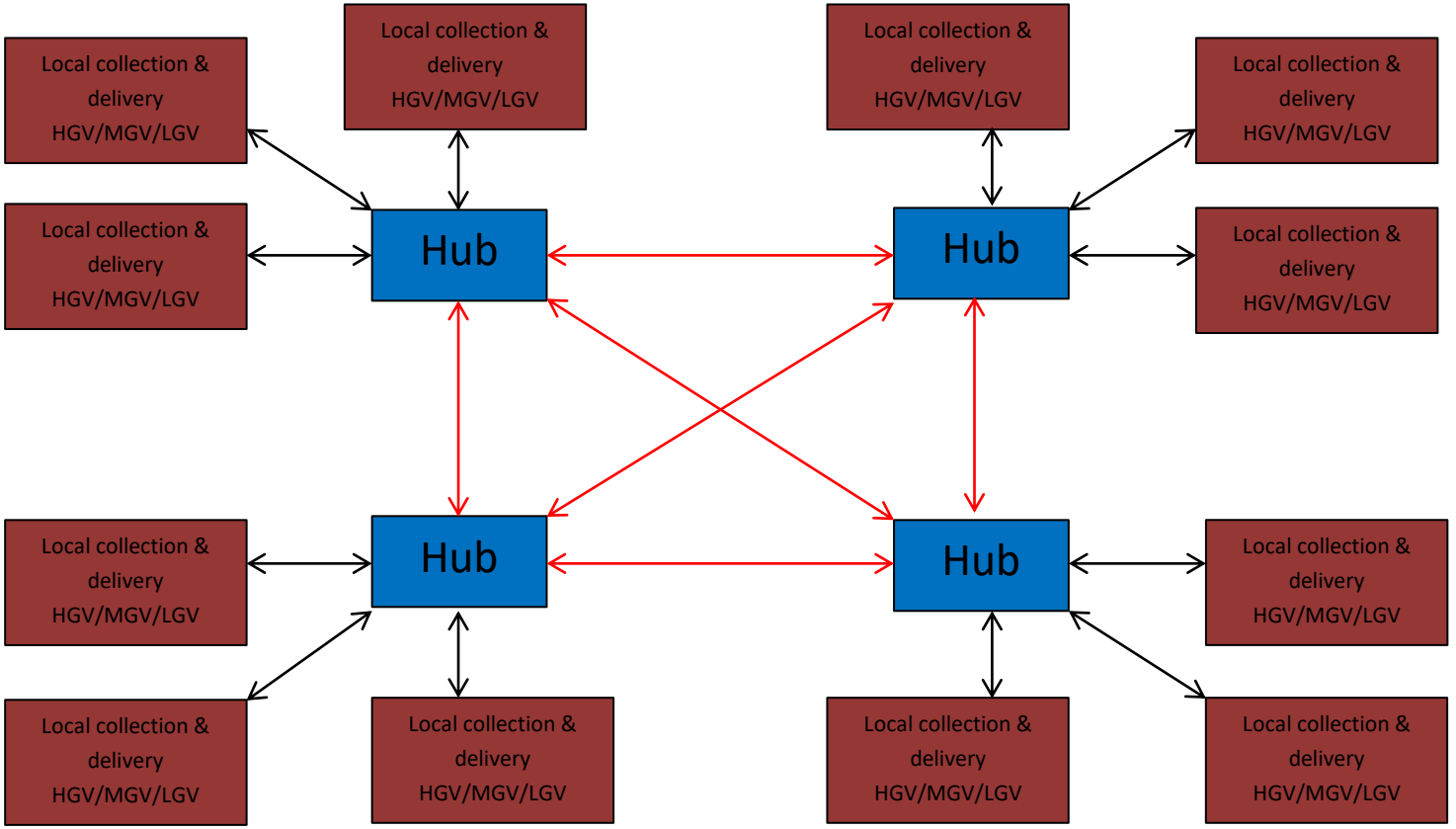

Figure A 4 Flow Diagram – Shared User Networks

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

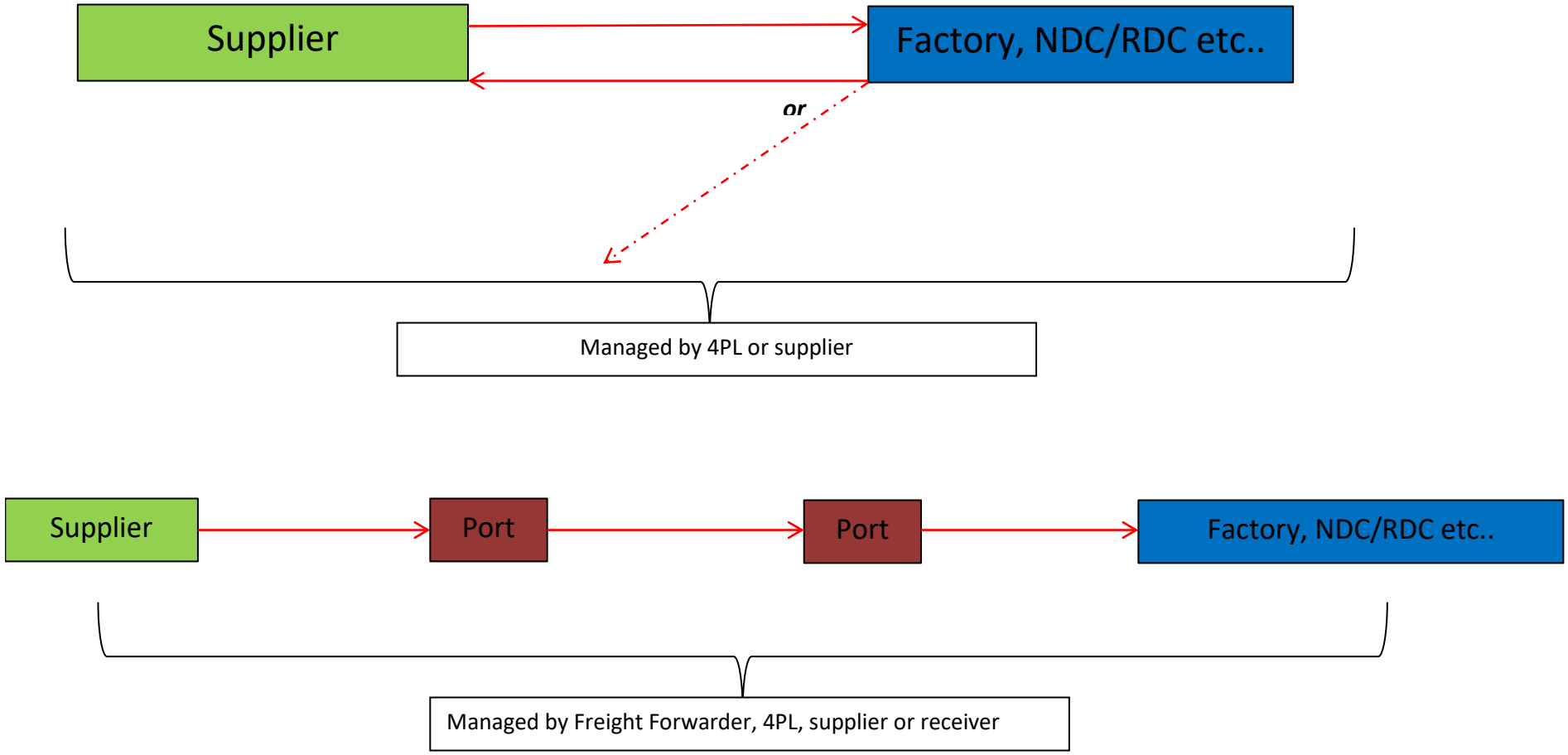

Figure A 5 Flow Diagram – Basic Supplier to Retailer

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

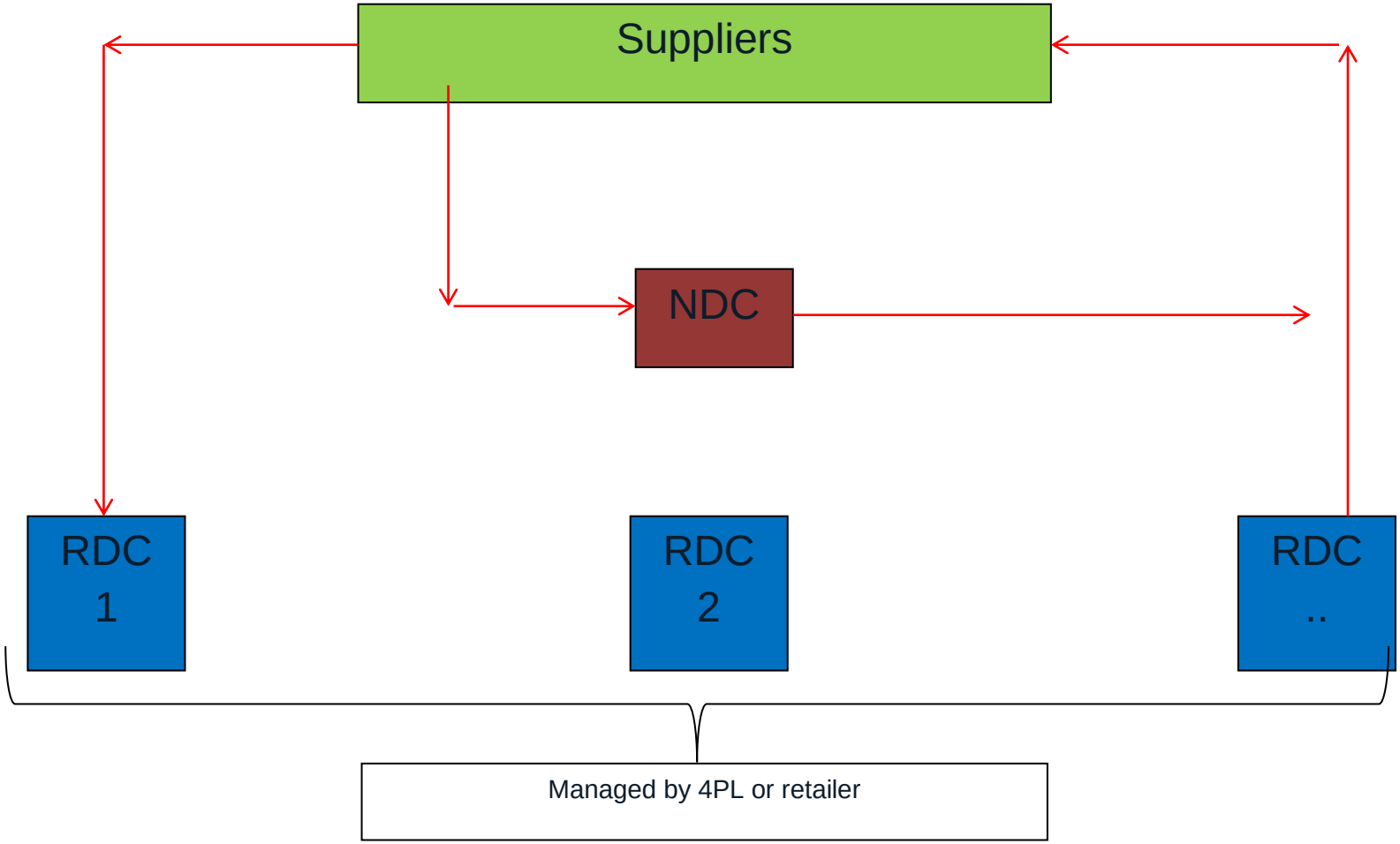

Figure A 6 Flow Diagram – Retail Factory Gate Collections

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.

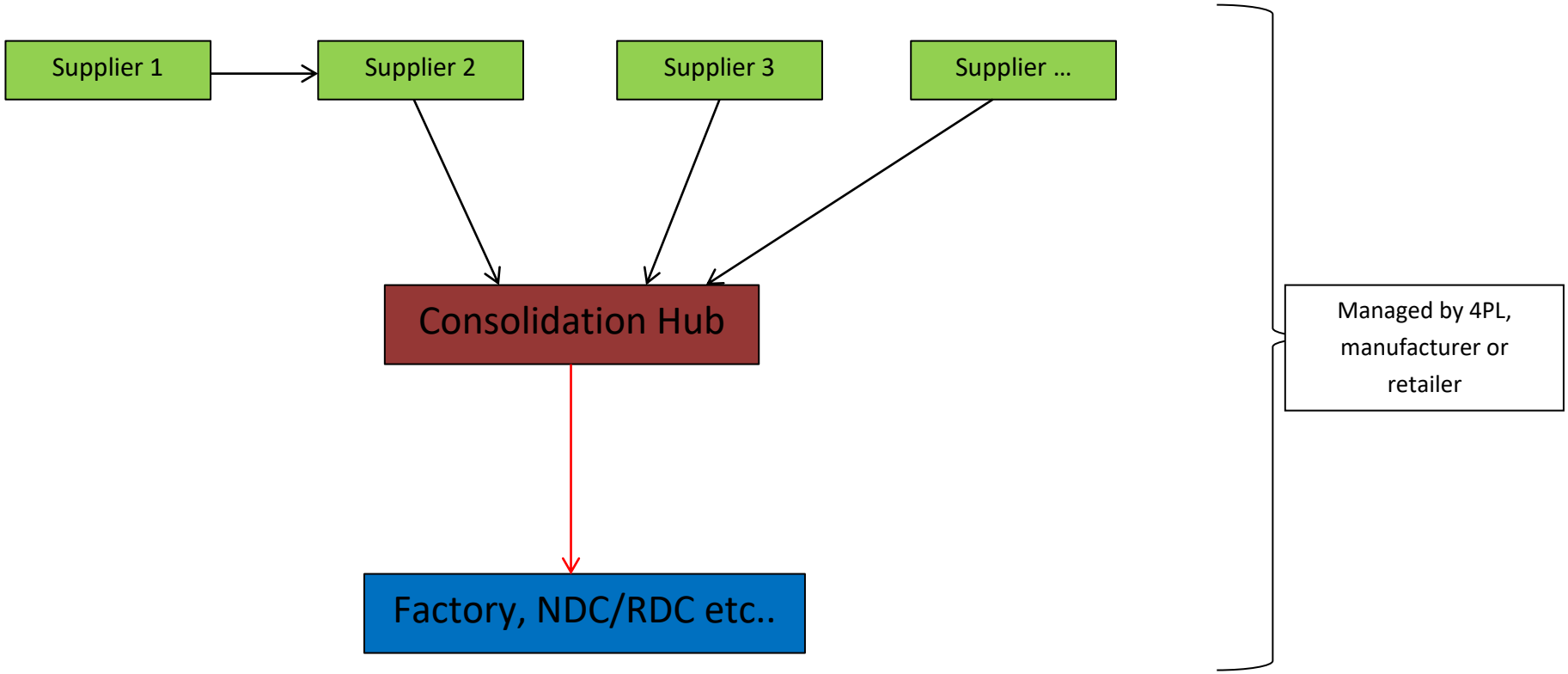

Figure A 7 Flow Diagram – Consolidating Supplies

LOGISTAR project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement no. 769142.