New ICT infrastructure and reference architecture to support Operations in future PI Logistics NETworks

D1.2 PI business and governance models

Document Summary Information

Grant Agreement No.	769119	**Acronym**	ICONET
Full Title	New **ICT** infrastructure and reference architecture to support **O**perations in future PI Logistics **NET**works		
Start Date	01/09/2018	**Duration**	30 months
Project URL	www.ICONETproject.eu		
Deliverable	D1.2 PI Business and Governance Models		
Work Package	WP1 ICONET PI Framework (PI Business Models and Key Enablers)		
Contractual due date	31/12/2019	**Actual submission date**	31/01/2020
Nature	R	**Dissemination Level**	PU
Lead Beneficiary	PGBS		
Responsible Authors	Marc Verelst (PGBS)		
Contributions from	See acknowledgements		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 769119.

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Glossary of terms and abbreviations used

Abbreviation Term	Description
C-EDG	Cross Enterprise Data Governance
DG	Data Governance
DOW	Description of Work
EU	European Union
FMCG	Fast Moving Consumer Goods
FTL	Full Truck Load
GA	Grant Agreement
IT	Information Technology
LSP	Logistics Service Provider
LTL	Less than a Truck Load
NMLU	New Modular Logistics Unit
PDN	Parcel Delivery Network
PI	Physical Internet
RFQ	Request for Quotes

1 Executive Summary

This is the final version of the ICONET Project's D1.2 Deliverable 'PI Business and Governance Models', addressing Task 1.2 "Formalization of the concept of networked collaborative logistics communities under the PI paradigm."

It outlines the state of the art on business models for horizontal collaboration and networked collaborative logistics communities, and also indicates which actions and activities are necessary to strengthen the basis for the implementation of the Physical Internet.

The purpose of this deliverable is, to provide the necessary insights into both business and governance models for horizontal collaboration and networked logistics collaborative communities, on which the ICONET consortium members can rely to evaluate the Physical Internet concepts they are developing as part of the project.

The document provides a holistic overview of both the business and data governance models which are needed to establish horizontal collaboration and networked collaborative logistics communities.

As a main conclusion, this deliverable will stress the necessity of open, standardized and integrated business models with governance structures in place to evolve from the current state of the art to networked collaborative logistics communities which will finally result in the implementation of the Physical Internet. It also demonstrates the relevance of these business and governance models and ensures that the technological developments of the Physical Internet concept do not take place in a business vacuum.

2 Introduction

2.1 Position of this report in ICONET

This a deliverable reflecting the work carried out under T1.2. ‘Formalization of the concept of networked collaborative logistics communities under the PI paradigm’. According to ICONET’s DoW, *Task 1.2* which describes the objective as *“Identify governance options and business models in underpinning the development of the PI concepts.”,* consists of three subtasks:

ST1.2.1 PI business models. [PGBS] Consider PI as the key driver for new business models and Innovation. Identify and analyze Business Models in the Realization domain, including production schemes, dynamic matching of supply and demand, personalization and retrofit centers, the distribution domain, including e-Warehouses, and certainly the mobility domain, with multimodality and synchromodality, nodes and hubs operations, city and last mile deliveries impact. Analyze PI Hubs, and the “as a service” business schemes for the provision and commitment of logistics resources and services.

ST1.2.2 PI collaboration schemes and governance options. [PGBS] Define and highlight the main governance options for collaboration under the PI paradigm (e.g. presence of a neutral trustee, intra pares collaboration, etc.). Survey ICONET Forum and ALICE members, perform thorough literature reviews, consolidate current best practices, and identify business schemes for the provision and commitment of logistics resources and services, not excluding the role of the public sector, in driving inter-company collaboration.

ST1.2.3 Data protection/security/confidentiality models. [INV] With regards to the aforementioned elements, and considering as starting point the collaboration agreements and state-of-the-art in existing logistic clusters, this task will study the best practices in terms of collaborative networks in order to highlight main benefits for participating organizations and identify incentives for other organizations to join. Furthermore, in this context, the task will identify possible information governance policies (i.e. publishing, sharing), taking into account data protection, confidentiality and security issues.

2.2 Purpose of this deliverable

The purpose of this deliverable is to provide sufficient background on business and governance models for horizontal collaboration and networked logistics collaborative communities. This background will enable all ICONET consortium members and other stakeholders outside the consortium to develop their deliverables and contributions enabling the Physical Internet concept with this business and governance background in mind.

As a consequence, technological developments towards the Physical Internet will not take place in a business vacuum, but in a true symbiosis where technological developments support the business and governance models and vice versa.

As such both technological developments and business and governance models will strengthen each other, enabling an accelerated implementation for the Physical Internet. Business models cannot be developed without technological breakthroughs, and technological breakthroughs cannot be realized without the development of business models.

This deliverable keeps a balance between theory (e.g. Business Model Canvas) and practice (e.g. examples of actual implementations like the Parcel Delivery Networks). As the deliverable takes into account the physical product, data and financial flows, it serves as a structured guide for both individuals and teams who want to contribute to the implementation of the Physical Internet concept.

2.3 Interdependencies with other ICONET tasks and deliverables

ICONET's PI-aligned digital and physical interconnectivity models and standards, as one of the fundamental project framework activities, has been purposed to support most of the subsequent work streams, with special emphasis given in ICONET's business plan and exploitation actions (D4.6 and T4.3), where following an extensive market and socio-economic analysis, a business plan will be constructed to elaborate the cost versus benefit dimensions for realizing the PI concept at scale, as well as the fundamentals that need to be in place to maximize return on investment.

PI Network Optimization Strategies and hub distribution policies (D1.4 and T1.3) have a more symbiotic relationship with this report, as they both address the hub distribution policies and the respective business models, including production schemes, dynamic matching of supply and demand, personalization and retrofit centers. These reports will evolve in parallel and influence each other over the course of the project.

Furthermore, the produced Business Models related to production schemes, the dynamic matching of supply and demand, distribution and multimodality will inspire and drive the Living Labs outputs, towards the generation of business value-adding components, aligned with envisioned PI evolution roadmap. PI's Business drivers will also be considered in the workplan of the Generic PI Case Study which is closely linked with the scope of work of the project's Living Lab scenarios.

Finally, the defined under this deliverable "data protection/ security/ confidentiality models", will guide the overall PI Reference Architecture (Task T2.1 and Deliverables D2.1 and D2.2), identifying underlying data protection and confidentiality concerns, taking into account the interacting components of the architecture, along with the relevant data models.

2.4 Outline of the report

This report is further structured in the following chapters:

Chapter 3 will review the horizontal collaboration business models which currently exist in logistics. This review was made from the perspective of the stakeholders who initiate, lead and develop these horizontal collaboration logistic business models. It consists of a conceptual overview, the business process, the business model canvas and practical examples of these horizontal logistics collaboration models. Beside the overall description of the models the collaborative management of information, physical and financial flows will also be outlined.

Chapter 4 will focus on the key elements which define collaborative networked logistics communities and will also outline the key implementations that are needed to move from the existing horizontal collaboration business models towards collaborative networked logistics communities with a special focus on scaling and interconnecting existing horizontal logistics collaboration models as a basis for the Physical Internet. The chapter will focus on business models, governance and data protection.

Chapter 5 will provide an overall conclusion for Deliverable 1.2. This overall conclusion will serve as a basis for the further development of the Physical Internet.

3 Networked Collaborative Logistics Communities - State of the Art

In this chapter the state of the art on networked collaborative logistics communities will be addressed.

A first section will address the value creation potential which can be unlocked through logistics collaboration. On one hand, there is the potential to reduce inefficiencies due to insufficient utilization of logistics assets. On the other hand, there is the opportunity to drive scale, which enables the creation of more direct routes, a reduction of empty miles and eventually in the long run a modal shift through large scale aggregation of existing transportation volumes at corridor level.

In the following three sections the different logistics collaboration models will be summarized.

In section 3.2 horizontal collaboration models initiated by shippers will be outlined at both the warehousing and transportation level. Section 3.3 builds further on these horizontal collaboration models initiated by shippers and describes collaboration models which are developed and managed by Logistics Service Providers (LSPs) at the warehouse, transportation and corridor level. Section 3.4 will conclude this overview and outline collaboration models which are initiated by semi-public and public organizations at the cluster level.

The description of the horizontal collaboration business models will be done through an overall description of the business model, an overview of the key business model processes in a table, the description of the business model canvas for each business model and to conclude a table with implemented examples of these business models.

The business model description, business processes and examples are considered to be self-explanatory for the reader. The business model canvas itself needs some further clarification. An overview of a business model canvas as it has been developed by Ostenwalder is provided in Figure 1.

Figure 1. The Business Model Canvas

<table>
<tr><td rowspan="2"><u>Key Partners</u></td><td><u>Key Activities</u></td><td rowspan="2"><u>Value Proposition</u></td><td><u>Customer Relationships</u></td><td rowspan="2"><u>Customer Segments</u></td></tr>
<tr><td><u>Key Resources</u></td><td><u>Channels</u></td></tr>
<tr><td colspan="3"><u>Cost Structure</u></td><td colspan="2"><u>Revenue Streams</u></td></tr>
</table>

The description of the different elements of a business model canvas is outlined in Table 2.

Table 1: The different elements of a business model canvas

Customer Segments	The different types of customers the business model wants to target.
Customer Relationships	The way in which the business model will interact with these customers.
Channels	The channels through which the interaction with the customers is done.
Value Proposition	The value proposition towards the different customers.
Key Activities	The key activities which are performed in the business model.
Key Resources	The key resources the business model is needing to be effective.
Key Partners	The key partners which interact with and support the business model.
Cost Structure	The cost structure of the business model (fixed, variable, etc.)
Revenue Streams	The revenue streams which are generated by the business model.

It needs to be noted that all these horizontal collaboration business models contain elements which are needed in order to establish the next level of logistics integration on which networked collaborative communities can be built.

To conclude, section 3.5 will provide a table overview of all collaboration models. This table overview will serve as basis to evolve from the current state of the art to collaborative networked logistics communities, the basis for the Physical Internet.

3.1 The need for Logistics Collaboration Models

The need for the collaborative logistics concept is driven by the underutilization of logistics assets.

From a transportation perspective for example, research for the EU funded[1] CO3 (Collaboration Concepts for Co-Modality) project has demonstrated that 20% of the distance driven by trucks, is empty. On top of this, trucks which are not driving empty have a vehicle fill rate which ranges between 55% and 60%.

As shown by the formula below, the metrics for empty and partially utilized trucks can be combined through multiplying the 80% of trucks not driving completely empty with the 55% to 60% vehicle fill rate and results in the overall asset utilization rate between 44% to 48%.

80% non-empty trucks x Fill rate (50 to 60) % = Transport Asset Utilization (44 to 48) %

[1] Grant agreement No 284926.

Beside the fact that logistics collaboration models have a large potential to reduce inefficiencies at both the warehousing and transportation level, principles of logistics collaboration can also be applied to drive value creating opportunities at a larger scale through the aggregation of transportation volumes at a corridor level opens the perspective to drive a modal shift from trucks to rail and/or waterborne transportation.

In this way, the current declining market share trend of rail and inland waterway transportation versus road transportation, which is outlined in Table 3, can be reversed.

Table 2: Market Share of Road, Rail and Inland Waterways in the EU 27

Transportation volumes in the EU27 (Billion Tom Km)							
YEAR	***ROAD***	***RAIL***	***WATER***	***TOTAL***	***ROAD***	***RAIL***	***WATER***
1995	1289	388	122	1799	72%	22%	7%
2000	1509	406	134	2049	74%	20%	7%
2005	1755	416	139	2310	76%	18%	6%
2010	1710	394	156	2260	76%	17%	7%
2015	1714	415	147	2276	75%	18%	6%
2016	1804	412	147	2363	76%	17%	6%

Data Source: EU Transportation Booklet 2018.

3.2 Logistics Collaboration Models Initiated by Shippers

Currently, there are three different logistics collaboration models which are initiated by shippers.

At the warehousing level, there is one horizontal logistics collaboration business model which is implemented between shippers. Subletting of warehouse space aims to valorise excess storage capacity available due to seasonality or changing business strategies with other shippers which have a need for storage capacity. This business model is described in subsection 3.2.1.

At the transportation level, there are two horizontal logistics collaboration business models which are implemented between shippers. The collaborative roundtrip business model, which is outlined in subsection 3.2.2, aims to reduce empty miles through the creation of closed loops. The collaborative vehicle fill business model, which is addressed in subsection 3.2.3, aims to improve the load factors of trucks between shippers with different product densities.

3.2.1 Horizontal Collaboration - Subletting of Warehouse Space.

This collaboration model exists when a shipper, who owns a warehouse or who rents a warehouse through a long-term lease, sublets parts of this warehouse, or even the complete warehouse to another shipper. At a minimum level this collaboration applies to subletting of storage space, but it can also be expanded to sharing of handling equipment and labour.

This collaboration model exists due to the fact that shippers and shippers' own warehouses which are underutilized during certain periods of time. In a somehow opportunistic approach, the non-utilized capacity of the warehouses is valorised through subletting at the initiative of the shipper which has the excess the storage capacity.

Currently, this form of collaboration takes place at an ad hoc basis and the identification of warehousing overcapacity is dependent on the specific region in which a warehouse is located and how well a shipper is embedded in this region. In most cases indeed, the subletting of warehouse space takes place because different shippers in a region get in touch with each other at a regional level through the chamber of commerce for example, which acts as a kind of intermediary to connect shippers.

Once a subletting opportunity is identified a short-term contract is made between the shippers in which the modalities of the collaboration are outlined. The agreed modalities are subject to negotiation between shippers which is based on market price levels. There is no evidence that gain sharing models like the Shapley Value for example are used.

This collaboration model is a very basic one which is in general applied at a very specific ad hoc basis. There is no structural data exchange between shippers on available warehouse capacity and there is no governance provided through a third party or trustee.

The process which is followed to implement the collaboration model to sublet warehouse space is outlined in Table 4.

Table 3: Process Steps for Subletting of Warehouse Space

Step	Description
1	Shipper A runs an analysis on current and future warehouse capacity utilization.
2	Shipper A concludes that there is excess warehouse capacity.
3	Shipper A connects with his/her network to communicate the opportunity.
4	Shipper B runs an analysis on current and future warehouse capacity utilization.
5	Shipper B concludes that there is warehouse capacity shortage.
6	Shipper A and B get in touch with each other on the warehouse subletting opportunity.
7	Shipper A and B decide to collaborate on warehouse subletting.
8	Shipper A and B negotiate a contract on warehouse subletting.
9	Shipper B stores his/her goods at the warehouse of Shipper B.
10	Shipper A invoices the storage costs to Shipper B.
11	The subletting of warehouse space is ended at the end of the contract.

The business model canvas for subletting warehouse space is outlined in Figure 2.

Figure 2. The Business Model Canvas for the Subletting of Warehouse Space

<table>
<tr>
<td rowspan="2"><u>Key Partners</u>
Chamber of Commerce
Law Firms</td>
<td><u>Key Activities</u>
Identifying partners
Setting up contracts
Subletting warehouse space</td>
<td rowspan="2" colspan="2"><u>Value Proposition</u>
For shippers which have excess warehouse space, subletting of warehouse space to other shippers
will drive the valorization
of this excess warehouse space
which results in
a better cost-structure
and a higher profit margin</td>
<td><u>Customer Relationships</u>
Direct interaction
between shippers
with excess storage
and shippers
with a storage need.</td>
<td rowspan="2"><u>Customer Segments</u>
All companies
with a need for
warehouse space</td>
</tr>
<tr>
<td><u>Key Resources</u>
Excess warehouse space</td>
<td><u>Channels</u>
Industry Meetings
Trade Fairs
Industry Conferences</td>
</tr>
<tr>
<td colspan="3"><u>Cost Structure</u>
Costs to identify partners.
Costs draft contracts</td>
<td colspan="3"><u>Revenue Streams</u>
Warehouse Rent</td>
</tr>
</table>

Examples of subletting warehouse space can be found below in Table 5.

Table 4: Subletting of Warehouse Space - Examples

Use Case	Description
P&G - Kellogg's	P&G is subletting it's automated warehouse in Michelin to store the Pringles business of Kellogg's.

It needs to be mentioned that there are some business models emerging which aim to create a market for excess warehouse space and to make the process of subletting this warehouse space more efficient and effective. Table 6 shows an overview of start-ups active in this space.

Table 5: Subletting of Warehouse Space - Start Ups

Start Up	Country	Description
Stock Booking	France	French start-up offering warehouse services on demand.
Flexe	United States	United States start-up offering warehouse services on demand.
Stockspots	Netherlands	Dutch start-up offering warehouse services on demand.

In conclusion, subletting of warehouse space can be regarded as a horizontal collaboration model with a low complexity which is implemented at an ad-hoc basis. It can be considered to be opportunistic and it's implementation is bound by specific timings and locations. Subletting of warehouse is generally implemented between two different shippers without the involvement of a trustee or third party. It is for this reason that not a lot of implemented examples are known, as these take place within a confidential environment between the shippers.

It needs to be noted that the collaboration model of subletting warehouse space is explored by innovative start-up companies, which aim to turn the valorisation of available excess warehouse capacity in a business model which has many parallels with AirBnB in the tourism business. In their business proposition these start-ups offer "warehouse services on demand" to their customers. This proposition is an excellent example of dynamic matching of supply and demand for warehouse services. It is from this more advanced perspective on subletting of excess warehouse capacity which must be regarded as a key step towards more complex horizontal collaboration models in logistics.

3.2.2 Horizontal Collaboration - Roundtrips.

Collaborative roundtrips are set up between shippers which have transportation synergies in point to point transportation lanes. These synergies occur when the origin of a transport lane for one shipper matches with the destination of a transport lane of another shipper and vice versa. It is important that the match is present at both sides of the transportation lane, which results in a closed loop.

The effectiveness of a match depends on the length of a lane. If the distance of a transportation lane is long the destination of the transportation lane of one shipper can be further from the origin of the transportation lane of the other shipper. In order to reduce the empty miles and to maximize the efficiency gains it is recommended that the origin of one shipper and the destination of the other shipper are located as close as possible to each other.

In more complex cases, triangles, rectangles, etc., might be created between a number of different shippers to create closed loops. It needs to be remarked that the complexity of collaborative roundtrips increases whenever more shippers are involved in these multipoint collaboration initiatives.

The criterion to have shippers being located as close as possible to each other is only one of the three logistics criteria which need to be met when collaborative roundtrips are put in place. Summarized collaborative roundtrips require the following three criteria to be effective:

1. Location: Shippers need to be located as close as possible to each other, so that roundtrips can easily be made without driving empty miles. This is the location criterion.

2. Transportation Mode: Shippers need to use the same mode of transport if they want to implement collaborative roundtrips. With mode of transport we refer here to the trailer type, which should be used by both shippers. It is obvious that a shipper in the chemical industry, which is using silo trailers, will not be able to collaborate with a shipper in the packaged goods industry, which is shipping palletized goods. This is the transportation mode criterion.

3. Time: Transport schedules of the individual shippers need to be synchronized in order to avoid waiting times at both the shipping and delivery points of each shipper. If the transportation schedules are not synchronized costs for waiting times will be incurred and while service levels and lead times will be impacted negatively. The larger the shipment flows of the shippers the higher the probability that transport schedules can be synchronized. This is the time criterion.

If the above criteria are met between two shippers, it is recommended that a specific process is followed to ensure that the collaborative roundtrips are implemented with the right governance structure. This governance structure is needed from both a business and data management perspective.

In Table 7 the different process steps for horizontal collaborative roundtrips are outlined. In order to keep the description of the process simple the assumption is made that the collaboration is taking place between two shippers: Shipper A and Shipper B.

Table 6: Process Steps for the Collaborative Roundtrips Business Model (without a trustee)

Step	Description
1	Shipper A shares shipment data for analysis.
2	Shipper B shares shipment data for analysis.

3	The shippers conduct an analysis on round trips.
4	The shippers find roundtrips within their joint set of shipment data.
5	An agreement between Shipper A and B is made to start the collaboration.
6	Transportation schedules between Shipper A and Shipper B are shared and analyzed.
7	A synchronized transportation schedule is made for Shipper A and Shipper B
8	A Request for Quotes (RFQ) is sent to the incumbent and non-incumbent hauliers.
9	A haulier is selected to execute the roundtrip at an agreed overall roundtrip price.
10	Horizontal roundtrip collaboration is started up operationally.
11	The Haulier invoices the total roundtrip price.
12	An agreement on Shipper A and Shipper B is made on how to share collaboration gains.
13	Shipper A and Shipper B pay their respective part of the invoice.

The process which is described above implies that there are only three parties are involved in the horizontal collaborative roundtrip: Shipper A, Shipper B and the haulier. In this set-up it directly surfaces that a very high level of trust is needed between these three parties.

In reality, these levels of trust are usually not existing, hence third parties are needed to perform this trusted role, enabling horizontal collaboration between the shippers. These other parties are named “trustees”, a concept which has been defined extensively in the EU funded CO3 project.

Beside the fact that the trustee is ensuring that the necessary trust is built between the collaborating parties, the trustee also ensures that there is compliance with antitrust legislation. This compliance is needed for the sharing of shipment data (Step 1 and 2), the Request for Quotes (RFQ) process (Step 8), the haulier selection (Step 9) and gain sharing (Step 12).

The fact that a trustee is needed to ensure trust and compliance shows clearly the need for governance. As a consequence, a more sophisticated version of the process for horizontal collaborative roundtrips is shared in Table 8 below.

Table 7: Process Steps for the Collaborative Roundtrips Business Model (with a trustee)

Step	Description
1	Shipper A shares shipment data for analysis to the trustee.
2	Shipper B shares shipment data for analysis to the trustee.
3	The analysis on round trips is done by the trustee.
4	The trustee finds round trips between Shipper A and B.
5	The trustee drafts an agreement between Shipper A and B to start the collaboration.
6	The trustee analyzes the transportation schedules of Shipper A and Shipper B.
7	The trustee makes a synchronized transportation schedule for Shipper A and Shipper B.
8	The trustee sends a Request for Quotes (RFQ) to incumbent and non-incumbent hauliers.
9	The trustee selects a haulier to execute the roundtrip at an agreed overall roundtrip price.
10	All partners start up the collaborative roundtrips under the governance of the trustee.

11	The Haulier invoices the total roundtrip price to the trustee.
12	The trustee shares the collaboration gains between Shipper A and Shipper B.
13	The trustee calculates the cost to be paid by Shipper A and Shipper B.
14	Shipper A and Shipper B pay their respective cost to the trustee.
15	The trustee pays the total cost for the roundtrip to the haulier.

It is clear that the above process puts the trustee as a kind of Chinese Wall in between the two shippers and between the two shippers and the haulier. In this way none of the stakeholders knows from each other which price is paid for the transportation before and after the collaboration, while an overall efficiency of the system is guaranteed by the trustee through the selection of the haulier with the overall best (cost) proposal. From a data sharing perspective none of the stakeholders have visibility on each other's costs which are reflected through the transportation price which is paid to the haulier.

It needs to be remarked that this set-up can be operated effectively and efficiently for one single transportation lane between two shippers, but requires a system or multiple systems to ensure that different combinations of shippers and hauliers can be connected to each other to create scalable network effects.

The business model canvas for collaborative transportation roundtrips is outlined in Figure 3.

Figure 3. The Business Model Canvas for Collaborative Transportation Roundtrips (Shipper Perspective)

<table>
<tr>
<td rowspan="2"><u>Key Partners</u>
Transportation Companies
LSP
Trustees</td>
<td><u>Key Activities</u>
Identifying partners
Identifying roundtrip matches
Setting up contracts
Orchestrating roundtrips</td>
<td rowspan="2"><u>Value Proposition</u>
For shippers
which are shipping their
freight with empty miles,
collaborative roundtrips
with other shippers
will eliminate
these empty miles
which results in
lower transportation costs
and a higher profit margin</td>
<td><u>Customer Relationships</u>
Direct interaction
between shippers
with empty miles.

Interaction between shippers
with empty miles
through a trustee</td>
<td rowspan="2"><u>Customer Segments</u>
All companies
shipping freight
with empty miles</td>
</tr>
<tr>
<td><u>Key Resources</u>
Empty Transport Miles</td>
<td><u>Channels</u>
Industry Meetings
Trade Fairs
Industry Conferences
Trustee Workshops</td>
</tr>
</table>

<table>
<tr>
<td><u>Cost Structure</u>
Costs to identify partners.
Costs draft contracts.
Trustee costs</td>
<td><u>Revenue Streams</u>
Transportation cost savings</td>
</tr>
</table>

Examples of collaborative transportation roundtrips can be found below in Table 9.

Table 8: Collaborative Transportation Roundtrips - Examples

Business Case	Country	Description
CHEP	Italy, Belgium	Roundtrips organized by CHEP based on data of pallet delivery and collection data.

In conclusion, collaborative roundtrips can be viewed as a horizontal collaboration model with a low complexity. Collaborative roundtrips are implemented in specific business cases where matches exist between the origin and destination locations of two or more shippers. As such the implementation of these collaboration models are bound by specific locations and shipment volumes.

Collaborative roundtrips have a competitive character towards the business models of incumbent transportation companies and LSP which continuously optimize the shipments of their existing customers using the same principles as used in the collaborative roundtrip business model.

Since the majority of roundtrips is implemented by these transportation companies or LSP not a lot of implemented examples of collaborative roundtrips which are directly implemented between two shippers are known.

3.2.3 Horizontal Collaboration - Vehicle Fill.

Where collaborative roundtrips are a relatively easy form of transport collaboration with only three requirements to be met, collaborative vehicle fill business models through freight consolidation are far more complex because three requirements need to be met on top of the location, transportation mode and time criteria. This because, unlike in the collaborative roundtrip business case, the truck or container is opened and goods are combined.

1. Density: Collaborative vehicle fill requires that the density criterion is respected. Ideally, matches are found between shippers with low density products and shippers with high density products. Density refers to the weight over volume ratio, where low density products have a low weight and a high volume and high-density products have high weight and a low volume. The ideal density for a product is 280 kg/m^3 which maximizes the total weight limit (22 tons) with the total volume limit (78.45m^3) of a standard truck. In a stand-alone scenario a shipper with low density products would cube out the trailer, while a shipper with high density product would weigh out the trailer. This is the density criterion.

2. Product compatibility: It is also needed that the products which are consolidated are compatible with each other. Compatibility refers to the fact that products may not have a negative impact on each other from a quality perspective. For example, it will not be possible to combine odorous

boxes of fish with boxes of diapers as there is a risk for contamination. This is the product compatibility criterion.

3. Operational: Collaborative vehicle fill through load consolidation also requires that there is operational capability to consolidate loads at either the warehouses of the shippers or alternatively at the warehouse of a LSP. There is a clear touchpoint with warehouse collaboration here, which has been outlined in Section 3.2.1. The requirement to combine cargo in a shared warehouse location can be defined as the operational criterion.

If the three logistics criteria for collaborative roundtrips and the three logistics criteria for collaborative vehicle fill business models are met between two shippers, it is recommended that a structured process is followed to ensure that the collaborative vehicle fill business model is implemented with the right governance structure. This governance structure is needed from both a business and data management perspective.

In Table 10, the different process steps for collaborative vehicle fill business models are outlined. In order to keep the description of the process simple the assumption is made that the collaboration is taking place between two shippers: Shipper A and Shipper B.

Table 9: Process Steps for Collaborative Vehicle Fill Business Models (without a trustee).

Step	Description
1	Shipper A shares shipment data for analysis.
2	Shipper B shares shipment data for analysis.
3	Analysis on collaborative vehicle fill is done.
4	Collaborative vehicle fill opportunities are found between Shipper A and B.
5	An agreement between Shipper A and B is made to start the collaboration.
6	A Request for Quotes (RFQ) is sent to warehouse operators for load consolidation
7	A warehouse location is selected to execute the load consolidation.
8	An agreement is made between Shipper A and B to share the warehouse costs.
9	Transportation schedules between Shipper A and Shipper B are shared and analyzed.
10	A synchronized transportation schedule is made for Shipper A and Shipper B
12	A Request for Quotes (RFQ) is sent to the incumbent and non-incumbent hauliers.
13	A haulier is selected to execute the collaborative vehicle fill trip at an agreed overall price.
14	Horizontal vehicle fill collaboration is started up operationally.
12	The haulier and the warehouse operator invoices the total consolidation price.
13	An agreement on Shipper A and Shipper B is made on how to share collaboration gains.
14	Shipper A and Shipper B pay their respective part of the invoice.

The process which is described above implies that there are only four parties involved in the horizontal collaborative roundtrip: Shipper A, Shipper B, the warehouse operator and the haulier. In this set-up it directly surfaces that a very high level of trust is needed between these four parties.

Even more than in the business case of horizontal roundtrip collaboration a trustee is needed to enable horizontal collaboration between the shippers, the warehouse operator and the haulier. The role of the trustee is needed to ensure legal compliance in the sharing of shipment data (Step 1 and 2), the analysis of these data (Step3) the Request for Quotes (RFQ) process for transport and warehousing (Step 6 and 12), the warehouse operator and haulier selection (Step 7 and 13) and gain sharing (Step 13).

The fact that a trustee is needed to ensure trust and compliance shows clearly the need for governance. As a consequence, a more sophisticated version of the process for horizontal collaborative roundtrips is shared in Table 11 below.

Table 10: Process Steps for Collaborative Vehicle Fill Business Models (with a trustee).

Step	Description
1	Shipper A shares shipment data for analysis to the trustee.
2	Shipper B shares shipment data for analysis to the trustee.
3	An analysis on collaborative vehicle fill is done by the trustee.
4	The trustee identifies collaborative vehicle fill opportunities between Shipper A and B.
5	An agreement between Shipper A and B is made to start the collaboration.
6	The trustee sends a Request for Quotes to warehouse operators for load consolidation
7	The trustee selects a warehouse location is selected to execute the load consolidation.
8	The trustee analyzes transportation schedules of Shipper A and Shipper B.
9	The trustee makes a synchronized transportation schedule for Shipper A and Shipper B
10	The trustee sends a Request for Quotes to the incumbent and non-incumbent hauliers.
11	The trustee selects a haulier for the collaborative vehicle fill trip at an agreed overall price.
12	The trustee starts up horizontal vehicle fill collaboration operationally.
13	The haulier and the warehouse operator invoices the total consolidation price to the trustee.
14	The trustee shares the collaboration gains between Shipper A and Shipper B.
15	The trustee calculates the cost to be paid by Shipper A and Shipper B.
16	Shipper A and Shipper B pay their respective cost to the trustee.
17	The trustee pays the total cost for the roundtrip to the haulier and warehouse operator.

It is clear that the above process puts the trustee as a kind of Chinese Wall between the two shippers and between the shippers, the warehouse operator and the haulier. In this way none of the stakeholders knows from each other which price is paid for the transportation and warehouse operations, while an overall efficiency of the system is guaranteed by the trustee through the selection of the warehouse operator and the haulier with the overall lowest cost. Also, from a data sharing perspective none of the stakeholders have visibility on each other's costs which are reflected through the costs which are paid to the warehouse operator and haulier by the trustee. The business model canvas for collaborative vehicle fill is outlined in Figure 4.

Figure 4. The Business Model Canvas for Collaborative Vehicle Fill (Shipper Perspective)

Key Partners

Transportation Companies
LSP
Trustees

Key Activities

Identifying partners
Identifying vehicle fill matches
Setting up contracts
Orchestrating transportation

Key Resources

Unfilled vehicles

Value Proposition

For shippers which are shipping their freight with suboptimal densities, collaborative vehicle fill with other shippers will drive a better utilization of trucks through a higher vehicle fill which results in lower transportation costs and a higher profit margin

Customer Relationships

Direct interaction between shippers suboptimal density freight.

Interaction between shippers with suboptimal density freight through a trustee

Channels

Industry Meetings
Trade Fairs
Industry Conferences
Trustee Workshops

Customer Segments

All companies shipping products with suboptimal density

Cost Structure

Costs to identify partners.
Costs draft contracts.
Trustee costs
Legal costs (contracts and validations)

Revenue Streams

Transportation cost savings

Examples of collaborative vehicle fill business models can be found below in Table 12.

Table 11: Collaborative Vehicle Fill Business Models - Examples

Business Case	Country	Description
P&G - Tupperware	Belgium to Greece	P&G and Tupperware are co-shipping light and heavy products from their plants in Mechelen and Aalst to Athens in Greece using multimodal transportation.

Collaborative vehicle fill business models can be viewed as a horizontal collaboration models with a high complexity which are implemented in specific business settings where matches exist between shippers based on the criteria mentioned above.

As such the implementation of these collaboration models are limited to specific business cases. Collaborative Vehicle Fill business models have also a competitive character towards the business models of transportation companies and LSPs which optimize Less than Truckload (LTL) shipments of their customers on an ongoing basis using the same principles as for collaborative vehicle fill business models. As the majority of collaborative vehicle fill business models are already implemented by these transportation companies or LSPs without the involvement of the shippers not a lot of implemented examples of collaborative roundtrips which are directly implemented between two or more shippers are known.

Also, here it needs to be remarked that the collaborative vehicle fill business model can be operated effectively and efficiently by the shippers for one single transportation lane, but that it requires a system or multiple systems and a third party to ensure that different shippers, warehouse and haulier combinations can be connected to each other to create network effects.

3.3 Logistics Collaboration Models Initiated by Logistics Service Providers

Logistics Service Providers (LSPs) are companies which offer logistics services. These logistics services include for example warehousing, transportation, value added services (e.g. kitting, repacking, etc.) and customs' management. In order to keep the focus on logistics collaboration models this section will only focus on warehousing and transportation.

It needs to be noted that LSPs are already consolidating transportation volumes and storage activities of the shippers and have as such established a private networked community which consists of different shippers, but without involving these shippers and sharing information to these shippers. This makes it an unstable network as individual shippers do not consider network disturbing effects when they decide to choose another LSP. With its openness however it is maybe closer to the Physical Internet than a typical Horizontal Collaboration initiative.

As part of their business development activities LSPs indeed aim to attract transportation volumes of shippers to optimize their transportation network through the reduction of empty miles. Also, in warehousing LSPs will offer their free storage capacity on the market.

Beside the fact that LSPs consolidate transportation volumes and storage activities for their customer base in their own private logistics network, there are four other logistics collaboration models identified, which are initiated by LSPs and are beyond the regular business of these LSPs. These models are briefly introduced now.

Subsection 3.3.1 summarizes Collaborative Distribution Platforms and Supplier Villages which aim to drive efficiencies between suppliers and customers. This can be either between shippers and retailer (Collaborative Distribution Platform) or between raw material suppliers and shippers (Supplier Village). Both collaboration models have elements which are similar to the collaborative vehicle fill business model described in subsection 3.2.3.

Subsection 3.3.2 describes Parcel Delivery Networks. These private logistics networks serve the growing parcel logistics business through sorting and consolidating the flows of parcels from the sender to the receiver. Also, here there are many similarities with the horizontal collaborative vehicle fill business model.

Finally, subsection 3.3.3 will address the collaborative corridor management business model, where LSPs consolidate freight of different shippers and allocate this to the most efficient transportation mode based on delivery time and cost requirements.

3.3.1 Collaborative Logistics Platforms.

A more advanced form of collaboration models on warehousing takes place through the development of Collaborative Logistics Platforms.

Collaborative Distribution Platforms and Supplier Villages are horizontal collaboration models which aim to build one collaborative order path for multiple stakeholders through a jointly operated warehouse. Typically, these collaboration models are developed by a LSP based on a specific business need to drive delivery efficiency through bundling of replenishment streams which are either too small or too infrequent on a standalone basis.

Delivery efficiency aims to have as frequent deliveries as possible in full truck loads. This allows the recipient of the goods to drive inventory reductions, improving its cash position. This while keeping the total number of deliveries as low as possible, it also improves the productivity of its inbound logistics activities. Collaborative Distribution Platforms respond to the need of the retailer for efficient deliveries, while Supplier Villages have the same objective for a shipper.

On the one hand, indeed small deliveries of less than a truckload (LTL) can be combined at the collaborative platform into one larger delivery, which improves the vehicle fill rate of a truck to a full truck load (FTL). On the other hand, infrequent full truckload deliveries can be rearranged in smaller but more frequent deliveries through the consolidation with other deliveries, keeping the advantage of being delivered in full truck loads, while smoothening the inbound flows to recipients which in turn may lower inventory costs.

The development of Collaborative Distribution Platforms and Supplier Villages is led by LSP, which develop their business model around a specific use case. From this perspective collaborative platforms can be regarded as business specific, long term and structural developments.

Once a retailer or a shipper express their need to develop a collaborative distribution platform or supplier village, the LSP starts to build a community of companies which deliver their goods to the retailer of the shipper. If the LSP is able to build a community a contract is made in which the modalities of the collaboration are outlined. The agreed terms are subject to negotiation between the LSP and companies which deliver the goods. The services provided by the LSP consist of the whole product flow, from the delivery and storage at the collaborative platform and the full handling of the order flow including transportation.

The LSP acts as a governance body which is consolidating the information needed to develop and run the collaborative platform. The LSP is using these data to charge the companies using the collaborative platform. The amount charged to these companies depends on the contractual agreement which is separately made between the LSP and each individual company using the collaborative platform. There is no evidence that gain sharing models like the Shapley Value, as advocated in the EU funded CO3 project, are used.

It needs to be noted that it can take significant time to develop collaborative platforms and that development efforts are in most cases taken upon a specific request of retailers and shippers who want to streamline the inbound flows of goods in their facilities. It is the LSP however who takes responsibility for all the preparatory steps and development efforts. The process for setting up a Collaborative Distribution Platform is described in Table 13.

Table 12: Process Steps for Collaborative Distribution Platforms

Step	Description
1	A retailer expresses the need to streamline his/her inbound flows.
2	The LSP starts the business development for a collaborative community.
3	The LSP attracts shippers to the collaborative community.
4	The LSP conducts an analysis on the feasibility.
5	If a business case exists the LSP negotiates contracts with each shipper.
6	All shippers store their goods in the collaborative distribution platform.
7	The LSP collects the orders from the retailer for each of the shippers.
8	The LSP consolidates one collaborative order for all shippers towards the retailer.

9	The LSP loads and delivers the consolidated order to the retailer.
10	The LSP charges the costs of the order assembly and delivery to each of the shippers.

The business model canvas for collaborative logistics platforms is outlined in Figure 5.

Figure 5. The Business Model for Collaborative Logistics Platforms

<table>
<tr>
<td rowspan="2"><u>Key Partners</u>
Retailers / Shippers</td>
<td><u>Key Activities</u>
Identifying partners
Platform Development
Setting up contracts
Platform Governance
Logistics Execution
Order Management</td>
<td rowspan="2"><u>Value Proposition</u>
For shippers
which are shipping
their freight at
suboptimal frequencies
and suboptimal quantities
collaborative logistics
platforms
will drive a better
utilization of trucks
and a higher
delivery frequency
which results in
a higher service level
lower transportation costs
and a higher profit margin</td>
<td><u>Customer Relationships</u>
Direct interaction
with retailers / shippers</td>
<td rowspan="2"><u>Customer Segments</u>
All companies
shipping products
to the retailers / shippers
in scope
at suboptimal frequencies
and suboptimal quantities</td>
</tr>
<tr>
<td><u>Key Resources</u>
Warehouse(s)
Trucks
Information System</td>
<td><u>Channels</u>
Industry Meetings
Trade Fairs
Industry Conferences
Business Development</td>
</tr>
<tr>
<td colspan="2"><u>Cost Structure</u>
Costs to identify partners.
Costs to draft contracts.
Platform development costs
IT infrastructure costs
Transportation Costs
Warehousing Costs</td>
<td colspan="3"><u>Revenue Streams</u>
Transportation Service Revenue
Warehousing Service Revenue</td>
</tr>
</table>

Examples of collaborative distribution platforms and supplier villages can be found below in Table 14.

Table 13: Collaborative Distribution and Supplier Villages - Examples

Business Case	**Country**	**Description**
ES3	United States	United States company running a Collaborative Distribution Platform in Pennsylvania with volumes of several FMCG companies.
2XL/ECS	Belgium/UK	Belgian company running a Collaborative Distribution Platform in Zeebrugge facilitating direct customer shipments in the United Kingdom.
HECORE	France	Initiative of HEnkel, COlgate and REckitt Benckiser to establish a Collaborative Distribution Platform in France
NEXTRUST Biscuit Platform	Belgium	Collaborative Distribution Platform implemented in Belgium as a living lab for the EU funded NEXTRUST project by TriVizor.

In conclusion, collaborative distribution platforms and supplier villages are horizontal collaboration models with a high complexity which is implemented at a structural basis. In contrast to subletting excess warehouse capacity these horizontal collaboration models have a much more profound impact on the operations of the stakeholders. The processes that apply to the ordering, storage and transportation of goods of each stakeholder are impacted and a continuous exchange of data is needed between the different stakeholders and the LSP.

Despite the fact that collaborative distribution platforms and supplier villages imply multiple stakeholders, they are focusing on a specific business case and as such do not have a dynamic character where stakeholders join and leave the collaboration model at a regular basis. It is for this reason that not a lot of implemented examples are scaled. There is an opportunity here to implement the ICONET concepts to drive the scalability of these business model towards the Physical Internet.

Also, at the level of urbanized areas city logistics hubs are developed to orchestrate the movements of freight into urban areas. Here the freight of different suppliers is consolidated to optimize the deliveries of this freight to multiple recipients within the city to reduce the nuisance from many distribution vehicles and NOx emissions in densely populated areas. City logistics Hubs can as such be regarded as collaborative distribution platforms with multiple recipients within the urban ecosystem. The focus of

City logistics Hubs is mainly on e-commerce flows and transportation towards stores. Depending on the set-up these city logistics hubs can be private or (semi) public. The term ‘’Stakeholders’’ includes: the city logistics hub operator, transportation companies, shippers, etc. The city logistics hub owner acts in most cases as the neutral party which consolidates the freight and allocates the logistics costs to the stakeholders.

Both the logistics collaboration business models of collaborative distribution platforms and City logistics hubs are explored by innovative start-up companies like ES3, CRC, Citydepot, etc. All of them aim to scale this logistics collaboration model as a step towards networked collaborative logistics communities.

3.3.2 Parcel Delivery Networks

Through the development of Parcel Delivery Networks, the LSP have created a business model which aims to consolidate and bundle a large number of small parcel deliveries, creating a private logistics network. Especially the fact that Parcel Delivery Networks focus on parcels and not on full pallets and containers, makes them a unique step up towards the Physical Internet. These parcels are the most similar concept to Physical Internet boxes.

A typical Parcel Delivery Network consists of several hubs where parcels which are originating from their catchment areas are collected and cross docked in shipments towards hubs from where the parcels are distributed to their destination.

Parcel Delivery Networks have a very diverse geographical footprint. Some of these can be established at a regional or national basis, but in most cases these parcel networks are active on a continental basis and even between continents. As such transportation in these Parcel Delivery Networks can be through vans (pick up & delivery), trucks (short distance between hubs) and airfreight (long distance between hubs).

The Parcel Delivery Network is owned by the LSP, which has the business objective to run the network with a profit. The LSP defines the price for the delivery of a parcel depending on its dimensions and origin-destination combination which is charged to either the sender or the recipient of the parcel. As such there is no gain sharing in between the LSP and the owners of the parcel.

The process for sending a parcel in a Parcel Delivery Network is described in Table 15.

Table 14: Process Steps for Parcel Delivery Networks

Step	Description
1	A shipper of a package chooses one of the available LSPs to send a parcel.
2	The shipper communicates dimensions, origin and destination of the parcel to the LSP.
3	Based on the dimensions, origin and destination the LSP quotes a price.
4	The shipper decides to ship the parcel with the LSP depending on the price.
5	The LSP arranges a pick-up of the parcel at the location of the sender (origin).
6	The LSP injects the parcel in the Parcel Delivery Network at the closest hub.
7	The LSP routes the parcel to the hub which is the closest to destination.
8	The parcel gets cross-docked across the hubs in the network according to the route.
9	The LSP delivers the parcel from the closest hub to the destination to the destination.
10	The LSP charges the price of the delivery to the sender or recipient.

The business model canvas for parcel delivery networks is outlined in Figure 6.

Figure 6. The Business Model for Parcel Delivery Networks

<table>
<tr>
<td rowspan="2"><u>Key Partners</u>
Transportation Companies
Airports</td>
<td><u>Key Activities</u>
Platform Development
Network Development
Logistics Execution
Order Management
Tracking Services</td>
<td rowspan="2"><u>Value Proposition</u>
For companies
and individuals
which need to ship parcels
parcel delivery networks
will ensure the most efficient
deliveries of these parcels
at the desired service level
and an optimal cost</td>
<td><u>Customer Relationships</u>
Website
to book parcel shipments

Smartphone app
to book parcel shipments</td>
<td rowspan="2"><u>Customer Segments</u>
Companies
shipping parcels

Individuals
shipping parcels</td>
</tr>
<tr>
<td><u>Key Resources</u>
Warehouse(s)
Trucks
Vans
Airplanes
Information System</td>
<td><u>Channels</u>
Industry Meetings
Trade Fairs
Industry Conferences
Business Development
Website
Smartphone Apps</td>
</tr>
<tr>
<td colspan="3"><u>Cost Structure</u>
Platform development costs
IT infrastructure costs
Transportation Costs
Warehousing Costs</td>
<td colspan="2"><u>Revenue Streams</u>
Parcel Shipment Revenue</td>
</tr>
</table>

Examples of Parcel Delivery Networks can be found below in Table 16.

Table 15: Parcel Delivery Networks - Examples

Business Case	Country	Description
DHL	Global	German company with a global Parcel Delivery Network.
Federal Express	Global	United States company with a global Parcel Delivery Network
UPS	Global	United States company with a global Parcel Delivery Network
GEFCO	Global	French company with a global Parcel Delivery Network

Parcel Delivery Networks are a business model which is based on some of the principles of logistics collaboration. Parcel Delivery Networks indeed consolidate freight of different shippers, but do not apply the principles of gain sharing, to distribute the value created by the freight consolidation with the shippers.

It needs to be mentioned however that Parcel Delivery Networks are very dynamic as these enable pick-up and deliveries of parcels at almost every location on the globe. As such these Parcel Delivery Networks act as Physical Intranets and can considered as a key building block to get to an open Physical Internet in which goods are shipped and stored in the most efficient and optimal way on a global scale.

It needs to be noted that the business model of Parcel Delivery Networks has synergies with e-commerce business models. E-commerce giants like Amazon and Alibaba offer their digital platform to sell and deliver goods using their own delivery network or existing Parcel Delivery Networks. Seen the growth of e-commerce, the developments at both e-commerce companies and Parcel Delivery Networks will be crucial for the development of the Physical Internet and need as such sufficient research and follow up.

3.3.3 Collaborative Corridor Management.

The Management of Logistics Corridors is another business model which contains characteristics of logistics collaboration. While Logistics Corridor Management has been traditionally focused on the development of infrastructure through for example the TEN-T corridor network in the European Union, there is an evolution to also start managing the flows on these logistics corridors.

Transportation of products on logistics corridors can indeed take place through different transportation modes. With the development of the synchromodality concept the need to ship products with only one transport mode is not necessary anymore. Synchromodality implies that the same goods flow can be shipped simultaneously through different transportation mode, with the option to dynamically switch between transportation modes within a logistics corridor depending on the available options and the timing at which goods are needed at the destination.

In order to apply synchromodality to dynamically switch the transportation mode used for a specific shipment, collaboration is needed between the different transportation modes, which are in general offered by different operators. Along the corridor activities of road transportation companies, rail and barge operators can indeed exist next to each other. Depending on the collaboration between the operators for these transportation modes, that transportation volumes can be dynamically and efficiently allocated to them.

The identified examples on logistics corridor management show that a LSP can play a key role to orchestrate synchromodal transportation within these logistics corridors. LSPs offer a transparent service to shippers, who want to have their goods delivered at a specific timing, using the most optimal transportation mode to meet this delivery timing.

The process to ship goods through a collaborative transportation corridor is described in Table 17.

Table 16: Process Steps for shipments in collaborative transportation corridors

Step	Description
1	The LSP decides to develop business activities on a specific corridor in line with its strategy.
2	The LSP identifies different operators active in the corridor (road, rail, inland waterways).
3	The LSP subcontracts transportation slots with the operators active in the corridor.
4	Shippers request the LSP to ship goods within the corridor with a specific delivery time.
5	The LSP selects the most efficient transport mode based on the delivery timing.
6	The LSP priorizes the shipments within the corridor based on the delivery timing.
7	The LSP switches shipments from one transportation mode to another if needed.
8	The LSP delivers the goods at the destination in a timely manner.
9	The LSP charges the shipper for the service, independent of the transport mode used.
10	The LSP pays the subcontracted services to the corridor operators.

The business model canvas for collaborative transportation corridors is outlined in Figure 7.

Figure 7. The Business Model for Collaborative Transportation Corridors

Key Partners

Road Transport Companies
Rail Operators
Inland Waterway Operators
Intermodal Terminals

Key Activities

Identifying partners
Corridor Development
Setting up contracts
Corridor Governance
Logistics Execution

Key Resources

Trucks
Intermodal Trains
Barges
Information System

Value Proposition

For shippers which are shipping their freight at long distances collaborative transportation corridors will drive a better utilization of transportation infrastructure with a synchromodal shift which results in lower transportation costs and a higher profit margin

Customer Relationships

Direct interaction with shippers

Channels

Industry Meetings
Trade Fairs
Industry Conferences
Business Development

Customer Segments

All companies shipping products over long distances

Cost Structure

Costs to identify partners.
Costs to draft contracts.
Corridor development costs
IT infrastructure costs
Transportation Costs

Revenue Streams

Transportation Service Revenue

Examples of Collaborative Corridor management can be found below in Table 18.

Table 17: Collaborative Corridor Management - Examples

Business Case	Country	Description
ECT-TCT	Belgium Netherlands Germany	ECT Hutchison Ports is offering synchromodal corridor services in Belgium, Germany and the Netherlands using inland waterway transportation.
ECS-2XL	Belgium Germany Italy United Kingdom	ECS-2XL is offering synchromodal corridor services on the TEN-T Rhine Alpine corridor using rail transportation.
Essers	Belgium Germany Italy Poland	Essers is offering synchromodal corridor services on the TEN-T Rhine Alpine corridor using rail transportation.

Collaborative Corridor Management is a business model which combines some of the principles of logistics collaboration with efficient scheduling of freight across different transportation modes within a transport corridor. The business model does not only aim to drive efficiencies within logistics corridors but also unlock opportunities to drive a modal shift from road transport towards more sustainable modes of transportation.

From the perspective of networked collaborative logistics communities, the Collaborative Corridor Management business model offers unique capabilities with regards to synchromodality. The scheduling and phasing of freight within a specific corridor across different transportation modes is not offered by any of the logistics collaboration models described earlier in this chapter. As such the Collaborative Corridor business model is a key foundation for the development of the Physical Internet.

3.4 Logistics Collaboration Models Initiated by the Public Sector

Beside logistics collaboration business models which are initiated by shippers and LSP, there are also collaborative transport activities which are initiated by the public sector. These activities are mainly centered around the development of logistics clusters.

Logistics clusters can be defined as logistics communities which are acting as points of gravity, which aggregate all logistics infrastructure and flows within a specific geographical area, with the objective to have efficient handling and transportation of goods within the cluster and to have efficient connections with other important clusters.

Logistics clusters consist indeed of many stakeholders which are all interdependent of each other and have the potential to create more value and scale than each stakeholder independently. The development of logistics clusters is centered on key logistics infrastructure. Three key areas of logistics infrastructure around which clusters are developed have been identified: Maritime Ports, Airports and Inland Terminals. These types of clusters will be outlined in subsections 3.4.1, 3.4.2 and 3.4.3.

3.4.1 Logistics Clusters – Maritime Ports.

Maritime ports act as gateways which handle massive product flows through an ecosystem which consists of many stakeholders like maritime vessel owners, maritime terminals, railway terminals, rail operators, inland waterway operators, warehouses, freight forwarder, etc. Taking into account the fact that the volumes passing through maritime ports are very large, coordination is needed within these ports and within their hinterland to handle the volumes in an efficient way. Port authorities act as a trusted party to enable coordination and orchestration between stakeholders from the public and private sector.

3.4.2 Logistics Clusters – Airports.

Airports fulfill a similar role as maritime ports. The stakeholders of airports are the airlines, the airport, cargo handlers, freight forwarders, etcetera. Having in mind the requirement to handle shipments with a very high throughput time, coordination is needed here too by a trusted party, which is in general fulfilled by the airport.

3.4.3 Logistics Clusters – Inland Terminals.

In the hinterland logistics clusters are formed by inland terminals which act as bundling point to drive the massification of flows with other clusters through acting as a bundling and switching point which combines different transportation modes. Inland terminals combine road transportation with inland waterway and/or rail transportation and as such enable bi-modal and tri-modal transportation.

Besides being key facilitators for intermodal transportation, these inland terminals also offer warehousing and repacking services generating synergies to drive vehicle fill optimization. The main stakeholders of inland terminals are the terminal operator, the rail operator, the inland waterway operator, the LSP, the shippers, etcetera. The orchestration and coordination of volumes is done by the terminal operator in close collaboration with local government institutions.

The approach to develop logistics clusters is specific to each cluster and as such it cannot be described in an overall process, as it has been done for each of the other logistics collaboration models. The business model canvas for logistics clusters developments summarizes all key characteristics in Figure 8.

Figure 8. The Business Model for Logistics Cluster Development

<table>
<tr>
<td rowspan="2"><u>Key Partners</u>
Shippers / Shippers
LSP
Transport Companies
Inland Terminals
Solution Providers</td>
<td><u>Key Activities</u>
Identifying partners
Cluster Development
Cluster Meetings
Training
(Platform Development)</td>
<td rowspan="2"><u>Value Proposition</u>
For regions
which are
sending and receiving
(large) freight volumes
collaborative clusters
will drive
a better collaboration and
coordination between
stakeholders
which results in
efficient freight flows
within the clusters
and with other clusters</td>
<td><u>Customer Relationships</u>
Direct interaction
with stakeholders

Shippers / Shippers
LSP
Transport Companies
Inland Terminals
Solution</td>
<td rowspan="2"><u>Customer Segments</u>
Regional Government</td>
</tr>
<tr>
<td><u>Key Resources</u>
(Information System)</td>
<td><u>Channels</u>
Industry Meetings
Trade Fairs
Industry Conferences
Business Development
Cluster Meetings</td>
</tr>
<tr>
<td colspan="3"><u>Cost Structure</u>
Cluster community development costs
(IT infrastructure costs)</td>
<td colspan="2"><u>Revenue Streams</u>
Government Funding
Membership Fees</td>
</tr>
</table>

Examples of Logistics Clusters can be found below in Table 19.

Table 18: Logistics Clusters - Examples

Business Case	**Country**	**Description**
Port of Antwerp - NxtPort	Belgium	Nxtport is the digital platform bringing all stakeholders of the Port of Antwerp together to build collaborative use cases to drive logistics efficiency.
Brussels Airport - Brucargo	Belgium	Brucargo is the community which has developed a digital platform in collaboration with the start-up Nallian to drive efficiency in the handling of airfreight.
Euralogistic - Delta 3	France	Euralogistic is the logistics cluster for the Hauts-de-France region driving massification and horizontal collaboration in between shippers, LSPs and government.
Zaragoza - Plaza	Spain	Plaza is the logistics cluster for the Aragon driving logistics efficiencies and collaboration at the logistics campus (Plaza) in Zaragoza.
Interporto Bologna	Italy	Interporto Bologna is the logistics cluster in Emilia Romagna and is developing inter cluster collaboration with the Port of Trieste.

Logistics Clusters must more be regarded as a business development approach instead of a business model. Logistics Clusters aim to enable logistics collaboration versus implementing and executing logistics collaboration. As such logistics clusters management is more focused on building collaborative communities, which is in some cases supported by the development of digital platforms.

Logistics Clusters are a unique enabler to drive collaboration as these clusters can act as a trusted and neutral party. Logistics Clusters have the opportunity to act as neutral and trusted data managers, which is demonstrated by the implementation of digital platforms. The service to store and manage data to be used for logistics collaboration is not offered by any of the logistics collaboration models described in this chapter. As such logistics clusters are a key foundation for the development of the Physical Internet.

3.5 Logistics Collaboration Models - Summary

Sections 3.2, 3.3 and 3.4 have provided an overview of the different business models which aim to drive efficiencies in the storage and transportation of goods through consolidation and collaboration. To get the full helicopter view of these business models a table summary will be made which is centred around 6 characteristics which are outlined in Table 20 below.

Table 19: Characteristics for Logistics Collaboration Business Models

Characteristic	Description
Number of Stakeholders	Outlines the number of stakeholders involved in the collaboration model, with a focus on the different type of stakeholders. For example: Shipper, Logistics Service Provider, trustee etc.
Type of activities	Outlines the activities which are subject of the logistics collaboration model. For example: warehousing, transportation, routing, scheduling, community building etc.
Risk Taking Initiator	Outlines which stakeholder is taking the risk to develop and implement the collaboration model. For example: Shipper, Logistics Service Provider, trustee etc.
Gain Sharing Model	Outlines how the valorisation of the efficiencies through collaboration and consolidation are distributed in between the different stakeholders. For example: Shapley value, proportional distribution, negotiated contracts etc.
Data Sharing	Outlines which data are shared by the different stakeholders and how these data are managed by the different stakeholders. For example: Trustee, Digital Platform etc.
Flexibility	Outlines the agility of the collaboration business model, with a focus on how fast and frequent members can change their position in the consortium. This does not only apply to changing freight volumes, origins and destinations, but also to changing the membership of the consortium.

As a result, the different logistics collaboration business models are outlined in Table 21.

Table 20: Overview of Logistics Collaboration Models

Collaboration Model	Number of Stakeholders	Activity Types	Risk Taking Initiator	Gain Sharing Model	Data Sharing Model	Flexibility
Subletting Warehouse Space	At least two shippers, LSP and Trustee are optional.	Storage Handling	No specific risk Use of existing assets	Contractual Negotiation or Gain Sharing (Shapley)	Data shred between shippers	Specific Business Case Small Member Base Low flexibility Low Scalability
Collaborative Roundtrips	At least two shippers and one LSP. Trustee is optional	Transportation	No specific risk Use of existing assets	Contractual Negotiation or Gain Sharing (Shapley)	Data shared between with trustee for overall analysis. Data shared with LSP for specific lane.	Specific Business Case Small Member Base Low flexibility Low Scalability
Collaborative Vehicle Fill	At least two shippers and one LSP. Trustee is optional	Handling Transportation	No specific risk Use of existing assets	Contractual Negotiation or Gain Sharing (Shapley)	Data shared between with trustee for overall analysis. Data shared with LSP for specific lane.	Specific Business Case Small Member Base Low flexibility Low Scalability
Collaborative Logistics Platforms	At least two shippers and one LSP. LSP takes the role of trustee.	Storage Handling Transportation Order Management	Risk for LSP for platform implementation	Contractual Negotiation	Data shared with LSP	Specific Business Case Medium Member Base Medium flexibility Medium Scalability
Parcel Delivery Networks	At least two shippers and one LSP. LSP takes the role of trustee.	Handling Transportation Routing	Risk for LSP for hub and spoke implementation	Fixed price grid with option to negotiate for B2B	Data shared with LSP	Collaboration Network Large Member Base High flexibility Large Scalability
Collaborative Corridor Management	At least two shippers and one rail / barge operators. LSP takes the role of trustee.	Transportation Routing Scheduling	Risk for LSP (subcontracting) and rail/barge operator (implementing service).	Contractual Negotiation	Data shared with LSP	Specific Business Case Medium Member Base Medium flexibility Medium Scalability
Logistics Clusters	At least two shippers. Public body takes the role of trustee.	Community Building Data Sharing	Risk for public body for data platform and community building.	Fixed pricing structure for data platform	Data shared with public body for data sharing.	Specific Business Case Medium Member Base High flexibility Large Scalability

The overview table for the logistics collaboration business models leads to the following conclusions:

1. The logistics collaboration business models which are initiated by shippers are specific to the business context in which the logistics collaboration model is set up and are as such shipper dependent. Due to their specificity these collaboration models are difficult to scale once identified. The importance of these business models lies in the demonstration that logistics collaboration can drive significant savings in warehousing and transportation costs relative to the baseline scenario of standalone non collaborative operations.
2. The logistics collaboration business models which are initiated by LSP have a much larger value creation potential due to the fact that these are less focused on a specific business case and are as such more open, flexible and scalable. The core activities of an LSP are indeed running logistics operations in the most efficient and effective way in a competitive environment. LSP enable consolidation of volume through collaboration mechanisms and concepts which do not need to be specifically known by the shippers.
3. The logistics collaboration business models which are initiated by the Public Sector are a necessity because these respond to a need which can't be satisfied by shippers and LSP. The strength of the public sector is specified by the fact that public entities can and must act in complete neutrality, while optimizing societal goals. From this perspective public entities can play an important role in building open communities which foster logistics collaboration models which can be implemented by LSP. These open communities can be uniquely focused on business model and community development, but also can have consist of activities which aim to manage data platforms allowing collaboration between different logistics collaboration communities and business models.

With the detailed examples in sections 3.2 to 3.4 and the overview table and conclusions in section 3.5, Chapter 3 provides a comprehensive overview of the state of the art with regards to logistics collaboration business models. The overview of the logistics collaboration business models on the basis of the stakeholders which initiate these business models can be regarded as an innovative approach to view logistics collaboration. The characteristics which have been outlined in overview Table 21 form as such a basis which is sufficient to make the comparison with the ideal state for networked logistics collaboration communities which will be outlined in Chapter 4.

4 Networked Collaborative Communities - Business Needs

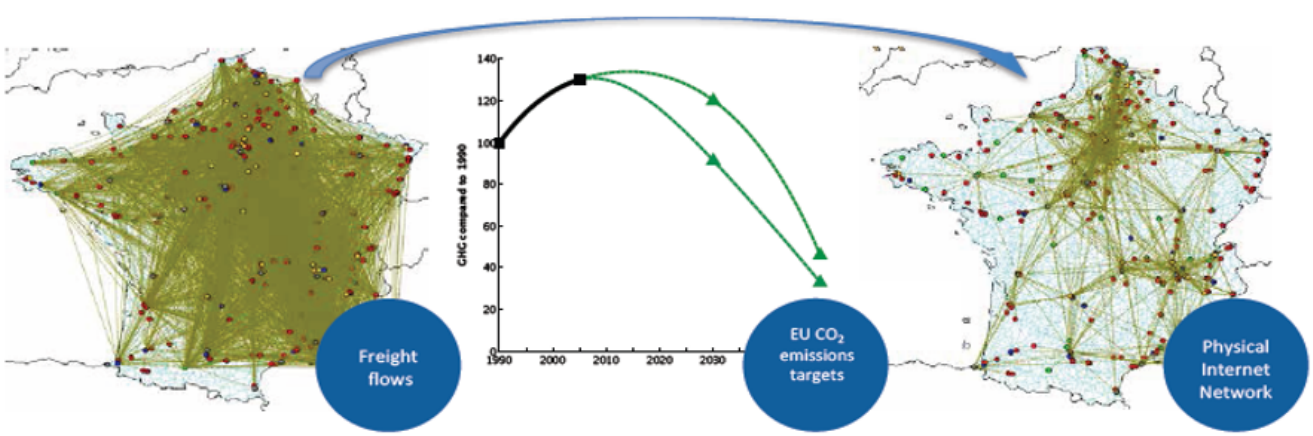
Chapter 3 provided an overview of the state of the art for logistics collaboration business models. As a base for this overview the risk-taking initiator, which is developing and implementing the logistics collaboration business model, has been used.

Chapter 4 will provide the key implementations which are needed to move from the existing logistics collaboration business models towards Networked Collaborative Logistics Communities.

It needs to be noted upfront that Networked Collaborative Logistics Communities are significantly more impactful than the Horizontal Collaboration Business Models described in Chapter 3. The scale effects generated by the networked aspect of Networked Collaborative Logistics communities enable benefits which extend beyond the typical cost savings in transportation and warehousing.

A study conducted by Ballot for France region concluded that the set-up of the Physical Internet in France for FMCG should drive such a scale that it would result in a reduction of 15% of total kilometers driven and a CO2 reduction of 60% due to the modal shift opportunities generated through the scale which is driven by the network effect. Figure 9 provides a graphical representation of this study.

Figure 9. The Physical Internet Concept Simulation for France FMCG



It is clear that the Horizontal Collaboration business models which are outlined in Chapter 3 are important building blocks to evolve into Networked Collaborative Logistics Communities. Collaborative Warehousing business models are very similar to Physical Internet Hubs, Collaborative Corridor Management business models will become the key instruments to drive a modal shift and CO_2 reductions.

First, section 4.1 will define the concept of Networked Collaborative Logistics Communities. Based on the definition of Networked Collaborative Logistics Communities section 4.2 will focus on the key implementations which are needed to move from the existing Horizontal Collaboration business models towards these Networked Collaborative Logistics Communities

4.1 Networked Collaborative Communities - A Definition

We define "Networked Collaborative Communities" as follows:

‘Open logistics networks consisting of competing and non-competing stakeholders through which goods are transported and stored in the most efficient way based on open logistics standards and governance and market based pricing mechanisms’.

Each of the elements of the definition will be described in subsections 4.1.1 - 4.1.3.

4.1.1 Networked Collaborative Communities - Open Logistics Networks.

To maximize their efficiencies networked logistics collaboration needs to be open and networked.

The openness of collaboration models refers to the fact that no stakeholder is excluded from joining a collaborative community to contribute to the increase its overall efficiency. Stakeholders can contribute to the efficiency of the community in many different ways. Some examples of stakeholder contributions are given below:

1. Freight owners can contribute through offering their freight volumes to the community.
2. Asset owners can contribute through offering their warehouses to the community.
3. Asset owners can contribute through offering their transportation assets to the community.
4. Service providers can contribute through offering their routing solutions to the community.
5. Service providers can contribute through offering freight tracking solutions to the community.
6. Trustees can contribute through offering governance mechanisms to the community.

Openness implies also that there is a dynamic dimension to collaborative communities.

On the one hand stakeholders should be able to join and leave the network at any time, which means that the composition of the community is dynamic and continuously changes over time.

On the other hand, stakeholders should also be able to change their contributions to the consortium. Freight volumes can indeed change as a result of changing business conditions and strategies. Assets can be added or withdrawn from the collaboration. Routing and freight tracking solutions can change due to evolutions in technology and business models. Trustee services might evolve due to automation and changes in legislation.

Next to the fact that logistics collaborative communities need to be open, they also need to be networked.

As a primary objective, logistics collaborative communities should form small networks in which efficiencies are generated through freight consolidation and optimized asset utilization. These logistics collaborative communities have similarities in scope with the Digital Intranets and can as such be considered as Physical Intranets.

However, the network aspect of logistics collaborative communities should not be limited to the Physical Intranet level. Truly open networking also implies that there should be interconnectivity between different logistics collaborative communities.

It should indeed be possible that freight travels from its origin to its destination through different logistics collaborative communities. All logistics collaborative communities or Physical Intranets should be directly or indirectly integrated into one overarching logistics collaborative community which is the Physical Internet. This concept is very similar to the Digital Internet which is basically an interconnected network of Digital Intranets.

4.1.2 Networked Collaborative Communities - Competing & Non-Competing Stakeholders

To maximize their efficiencies networked logistics communities should not only contain non-competing stakeholders, but also stakeholders who are direct competitors. The fact that competing stakeholders should be collaborating in collaborative networked logistics communities raises some controversy within the industry. This is due to the fact that transportation and logistics are regarded as a source of competitive advantage.

EU funded projects like CO3, Nextrust and Clusters 2.0 however have demonstrated that collaboration in warehousing and transportation offers a collaborative advantage, as inefficiencies which can't be eliminated by individual stakeholders, can be resolved through sharing of freight and/or assets.

A typical example of the collaborative advantage in logistics can be found in collaborative vehicle fill where shippers with high and low product densities can optimize truck fill together through collaboration. Another example is intermodal freight, where multiple shippers are combining their freight to form a full train. A practice which is almost impossible to manage seen the fact that annual freight volumes of 7500 containers to fill a freight train in one direction of a closed loop.

In order to set up a collaborative networked community between competitors a governance structure is needed which ensures that the following concerns are addressed:

1. The collaboration needs to be in compliance with antitrust laws.
2. Data which is shared in the consortium is kept confidential and secure.
3. Confidence is built through a fair treatment of all members.

4. Responsibility in case of SLA violations.
5. Payments to the right operators.

In order to set up this governance structure a neutral body is needed to manage the collaborative networked community. This neutral body has been defined by both the EU funded CO3 and Nextrust projects as the trustee. As already indicated by the word "trustee" itself the trustee role ensures that the necessary levels of trust are generated through covering the three main concerns which are listed above.

4.1.3 Networked Collaborative Communities - Open Logistics Standards and Governance.

In networked collaborative logistics communities, standards are needed from both an equipment (subsection 4.1.3.1.) and data governance (subsection 4.1.3.2.) perspective.

4.1.3.1 Open Logistics Standards - Modular Shipping Units.

From an equipment perspective, substantial developments have been done to develop isomodular re-usable containers through the EU-funded Modulushca project. As a result, GS1 Germany is implementing a standard on re-usable containers to be used in between German retailers and FMCG shippers.

The Clusters 2.0 project has taken the development of isomodular re-usable containers a step further through the development of New Modular Logistics Units which enable an efficient transfer of larger quantities of goods from one transportation mode to another.

4.1.3.2 Open Logistics Standards - Data Sharing & Governance.

From a data sharing perspective, substantial work has been done to develop standards and data sharing platforms. EU funded projects like Synchronet, AEOLIX and Nextrust[2] have been focusing on data exchange and data exchange platforms.

The ICONET consortium has done extensive work to consult recommendations from the Data Governance Institute. This institute defines “Data Governance” (DG) as a system of decision rights and accountabilities for information-related processes, executed according to agreed-upon models which describe who can take what actions with what information, and when, under what circumstances, using what methods.”

Data governance refers to the overall management of the availability, usability, integrity, and security of the data employed in an enterprise. Data governance represents a practice of organizing and implementing policies, procedures and standards for the effective use of an organization’s structured/unstructured information assets.

[2] Grant agreements No 636354, 690797 and 635874 respectively.

According to DAMA International, a not-for-profit, vendor independent, global association of technical and business professionals dedicated to advancing the concepts and practices of information and data management, Data Governance encompasses eleven focus areas which are highlighted in Figure 10.

Figure 10. Data Management Knowledge Areas

Table 22 provides further perspective on the eleven Data Management knowledge areas.

Table 21: Data Management Knowledge Areas

Data Governance	Planning, oversight and control over management of data and the use of data and data-related resources. While we understand that governance covers 'processes', not 'things', the common term for Data Management Governance is Data Governance, and so we will use this term.
Data Architecture	The overall structure of data and data-related resources as an integral part of the enterprise architecture
Data Modeling & Data Design	Analysis, design, building, testing, and maintenance
Data Storage & Operations	structured physical data assets storage deployment and management
Data Security	ensuring privacy, confidentiality and appropriate access.
Data Integration & Interoperability	acquisition, extraction, transformation, movement, delivery, replication, federation, virtualization and operational support.
Documents & Content	storing, protecting, indexing, and enabling access to data found in unstructured sources (electronic files and physical records), and making this data available for integration and interoperability with structured (database) data.
Reference & Master Data	Managing shared data to reduce redundancy and ensure better data quality through standardized definition and use of data values
Data Warehousing & Business Intelligence	managing analytical data processing and enabling access to decision support data for reporting and analysis
Metadata	collecting, categorizing, maintaining, integrating, controlling, managing, and delivering metadata
Data Quality	defining, monitoring, maintaining data integrity, and improving data quality

At its core, data governance is about establishing methods, and an organization with clear responsibilities and processes to standardize, integrate, protect and store corporate data. The main benefits of data governance an organization can have are outlined in Table 23.

Table 22: Main benefits of data governance.

Risk Management	Data Governance helps to ensure the continued existence of the organization through risk management and optimization of the use of data.
Standard Rules for data use	Data Governance sets out how data are consumed inside and outside organizations and how data are shared with third parties in collaborative environments. As a consequence, organizations benefit from Data Governance due to improved internal and external communication
Trust	In a globalized world compliance to recognized data management models helps organizations to create trust which develops alliances and fosters collaboration.

Increased value of data	Holistic data management facilitates the administration of information and enables better decision-making processes at both the individual and collective level.
Cost Savings	The availability, usability, integrity and security of data permits operational and administrative cost reductions and an efficiency increase through the coordination of efforts. Moreover, it also reduces operational friction between organizations in collaborative environments.
Standard processes	Data management and governance imply the need of repeatable processes and ensure transparency of these processes. This aspect is important in the scope of an individual organization, but it is even more important in a collaborative ecosystem, as the Physical Internet, where processes and services consume and generate data which affect to more than one organization at the same time
Stakeholder Management	Data governance also facilitates the protection of stakeholder needs.
Capability Development	Data Governance facilitates the training of staff allowing a common approach to data issues.

In a collaborative environment there is a need for Cross-Enterprise Data Governance (C-EDG), which focuses on high-level planning and control of the entire data management function. DAMA describes this as "the business function of planning for, controlling and delivering data and information assets to the organization."

The term C-EDG refers to an organization data governance effort beyond its borders that encompasses two or more of the data management functions listed above in different organizations this as opposed to the simpler Data Governance, which refers to a specific function within a single enterprise.

C-EDG is comprehensive in scope. Most organizations that implement a Data Governance initiative start with a much narrower focus on only one or two of the data management functions listed above. Once an organization has gained experience governing the selected functions internally, it can expand to include other data management functions in collaboration with other companies such as clients or providers. In that case, the C-EDG effort can provide a common vision, principles and guidelines that support several functions including data security and privacy for the collaborative community.

A data governance set of policies in a collaborative environment (Cross-Enterprise Data Governance - C-EDG) formally outlines how business activity monitoring should be carried out to ensure that cross organizational data is accurate, accessible, consistent and protected. The policies define who is responsible for the information under various circumstances and specifies what procedures should be used to manage it.

A collaborative data governance policy is a living document. This means it is flexible and can be quickly changed in response to changing needs. An effective data governance policy requires a cross-discipline approach to information management and input from executive leadership, finance, operations, information technology (IT) and other data stewards within all the organizations.

Collaborative data governance policies should be based on business and compliance requirements, the data governance strategy, and the data privacy and confidentiality principles of each organization participating in the collaborative environment. Data governance policies in collaborative environments should include the elements listed in Table 24.

Table 23: Key elements of data governance policies in collaborative environments.

Data Classification	This policy establishes a classification scheme that applies throughout the organizations to define the criticality and sensitivity of enterprises' data (e.g., public, confidential, top secret). This scheme should define the security levels and appropriate protection controls and should address data retention and destruction requirements. Many organizations find it useful to associate confidential data types to the laws and regulations that govern them, as part of the classification.
Information Security	This is typically a high-level policy that describes the purpose of information security efforts: to maintain confidentiality, integrity, and availability of data. This is the core policy of an information security management system (ISMS) and is typically supported by a series of supplemental policies that focus on specific areas, such as acceptable use, access control, change management, and disaster recovery.
Data Privacy	This policy describes the practices followed by the organizations when it comes to managing the lifecycle of customer data as it relates to privacy—that is, the retention, processing, disclosing, and deleting of customers' personal data. The content of the policy will vary depending on the applicable legal framework, which in turn will vary depending.
Data sensitivity	This policy determines whether, or to what degree, the data is considered particularly sensitive – for example personal, commercial, environmental, national security or legal sensitivities may be evident in the data. It is also important to consider how the sensitivity of data may change following the application of the Data Sharing Principles. For example, personal data may include detailed information about the location, gender, etc. if access to the data is limited to authorised users, but this same information may need to be removed if it were to be released publicly.
Data Sharing	This policy addresses the need to establish data sharing agreements between organizations, that is, a data custodian and the organisation receiving their dataset (for example, private company, final customer, logistics service provider, infrastructure managers, government agencies, non-government organisation, etc.).

	These agreements may include how a purpose test is satisfied and details of projects covered by the agreement. It should also specify what the data can and can't be used for, and provide information on any sanction that may be imposed if the terms and conditions of the agreement are not adhered to (this may include reference to legally enforceable sanctions available under any relevant law). In the data sharing agreement, the responsible department of the organisation receiving or accessing the data would agree that all users within their organisation will abide by the terms and conditions for accessing the data. The responsible department may be required to provide and maintain a list of individuals (or groups of individuals within an organisation) that are accessing data under the agreement. In some cases, individual users within an organisation may also need to agree to conditions of use, which may be part of authorisation criteria. It is best practice to make data sharing agreements publicly available to maximise transparency.
Data Anonymization	Data anonymization policies are oriented to alter data across systems and organizations so it can't be traced back to a specific individual, while preserving the data's format and referential integrity. There two main techniques allowing data masking. Pseudonymization – a data management procedure by which personally identifiable information fields within a consumer or customer data record are replaced by one or more artificial identifiers, or pseudonyms, which may be recalled at a later date to re-identify the record. Anonymization – the process of either encrypting or removing personally identifiable information from data sets so that the people whom the data describes remain permanently anonymous. The legal distinction between anonymized and pseudonymized data is its categorization as personal data. Pseudonymous data still allows for some form of re-identification (even indirect and remote), while anonymous data cannot be re-identified. Pseudonymization techniques differ from anonymization techniques
Data Retention	A data retention policy, or records retention policy, establishes a protocol for retaining information for operational or regulatory compliance needs. A comprehensive data retention policy should outline the business reasons for retaining specific data as well as what to do with it when targeted for disposal.

	In collaborative ecosystems where organizations are sometimes collaborators and sometimes competitors, this policy becomes very critical.
Data Destruction	A data destruction policy ensures that retired devices and media have their contents securely removed, destroyed, or overwritten so that it is extremely difficult or impossible to later retrieve data. A data destruction policy encompasses a huge number of devices: personal computers and laptops, hard drives, flash memory devices, mobile Phones, CDs, DVDs, Blu-Rays, and other tape storage drives. A data destruction policy is critical within an organization but it becomes crucial in collaborative environments where organizations use and hold external data from others collaborators. In collaborative ecosystems where organizations are sometimes collaborators and sometimes competitors, this policy becomes very critical.

The decision on which operating model should be adopted is part of the initial steps in setting up a collaborative data governance strategy. Its importance relies on the fact that:

1. It outlines how the governance program will operate.
2. It sets the expectations of escalation and decision making as well as program oversight.
3. It provides the infrastructure for ownership and decision making.

According to the literature, there are two reference models to take into consideration: centralized and decentralized, each with their own pros and cons outlined below. Similar to a top-down project management model, a centralized operating model relies on a single individual to make decisions and provide direction for the data governance program.

Different titles may be used to reflect this role, such as: Chief Data Officer, Chief Information Officer, Chief Data Steward, Data Governance Director, Data Stewardship Director, and so forth. For the purpose of reflecting this role into the operating model with a common name, this individual can be referred as the Data Governance Lead.

4.1.4 Networked Collaborative Communities - Market Based Pricing Mechanisms.

The EU funded CO3 and Nextrust projects have researched the gain sharing mechanisms to be used in horizontal collaboration business models. These gain sharing mechanisms like the Shapley Value have the ability to work well in collaboration business models with a low complexity, like for example the collaborative business models initiated by shippers.

Within networked collaborative communities which depend on a large number of different stakeholders there is a concern that these gain sharing models are less effective. Therefore, it is proposed to use Market Based Pricing Mechanisms where free storage and transportation capacity is offered based on dynamic prices within the market. In practice this would mean that every stakeholder which has excess capacity should offer this capacity on the market like at the price that this stakeholder would like to get for the use of this excess capacity.

This set-up which should work as the Uber concept where prices for transportation are defined in a dynamic way. Uber prices are indeed based on the available capacity within the Uber ecosystem (supply of transportation) and the users who request transportation (demand of transportation).

Within networked collaborative communities routing algorithms should fulfill a similar function as the Uber concept with the objective minimize the costs to transport freight throughout the collaborative network at the lowest cost, using the available capacity in the most efficient way possible.

4.2 Networked Collaborative Communities - Implementations Needed

Based on the above this section will outline the implementations which are needed to move from the existing logistics collaboration business models towards networked logistics collaborative communities. For consistency reasons the structure, which addressed the different elements of the definition of Networked Collaborative Communities in subsections 4.1.1 to 4.1.3, will be reapplied.

The list of recommended implementations refers to business and governance models only. It needs to be noted that there is also an important technology aspect which needs to be implemented beside these business and governance models. The technology aspect consists for example of smart algorithms, artificial intelligence and machine learning, blockchain, IOT devices, etcetera. These technological aspects are not included in the scope of this deliverable.

4.2.1 Networked Collaborative Communities - Open Logistics Networks.

The need to build open logistics networks can be best met through a further development of collaborative logistics platforms and parcel delivery networks. There is much more potential in these logistics collaboration business models initiated by LSP than in those logistics collaboration models initiated by shippers as these have the advantage that substantial freight volumes are already consolidated in their current state.

Roundtable discussions between a diverse group of FMCG shippers which were led by the Branded Product Shippers Association (AIM) have led to the conclusion that logistics collaboration should be led by LSP and not by the shippers. This as logistics is the core business of LSP and not of the shipper.

Collaborative logistics platforms and parcel delivery networks are now set up as private Physical Intranets. The opportunity as such lies in the interconnection of these logistics collaboration models into a true, open Physical Internet.

Connections done by the Branded Product Shippers Association with the CLECAT and the IRU lead to the conclusion that collaboration projects between LSP are not existing at this moment. As such it is recommended to start up these collaboration models to drive the evolution towards Networked Logistics Collaborative Communities.

It needs to be mentioned that collaboration between LSPs and Parcel Delivery Networks will generate the scale which will enable them to create collaborative corridor business models. This is very important as it will drive the so much needed modal shift which can generate up to 60% CO2 reductions as mentioned by the Physical Internet study in France by Ballot.

4.2.2 Networked Collaborative Communities - Competing & Non-Competing Stakeholders.

In the Physical Internet all products of competing companies end up in the same supply chain at a specific timing and location. For consumer goods for example this is in the physical stores and e-commerce platforms where these products are offered by the retailers to the end consumers. In the agro-alimentary industry raw materials like milk and wheat which is produced by different agricultural farms end up in the same production batch.

As consolidation of competitive product flows is already taking place at specific timings and locations in current supply chains it makes a lot of sense to extend this consolidation up- and downstream in the supply chain.

Collaboration between competing companies is complex however and also confronted with a lot of legislative and cultural barriers. Therefore, a significant and decisive role needs to be played by neutral entities like cluster developers (ports, airports, inland terminals), industry associations (AIM, ESC, CLECAT) and technology platforms (i.e., Alice,). In this way these neutral bodies can pave the way for LSPs to create interconnected networked collaborative communities.

4.2.3 Networked Collaborative Communities - Open Logistics Standards and Governance.

For the development of Networked Collaborative Communities, it is necessary that open logistics standards are built. From the implementation perspective, modular shipping units are seen as an enabler for these networked collaborative communities. Modular shipping units cannot be considered as a showstopper if these are not adopted and implemented. For Data Governance however the perspective is different as the lack of data sharing and governance models are a clear showstopper towards the implementation of networked collaborative communities.

As such it is necessary that networked collaborative communities need to have an agreement for data sharing, including an established data governance and management model in place to be able to work together and deliver adequate and profitable performance.

To be able to populate the ICONET network with relevant data a service provider must be created to accommodate the transfer of relevant data. A key element of this data transfer would be to identify a single entity in which the data management model validation would be entrusted by the collaborative cluster so that the administrative entities responsible for this transfer will not have to communicate with each entity that comprises the cluster individually.

The single entity responsible for this work would take the consolidations and agreements regarding data already in place, and collaborate with the ICONET stakeholders in order to agree in the terms and conditions on which the data will be transferred and managed.

Ideally, the front facing service provider responsible for the data transfer needs to have the following services in place to deliver a consistent performance:

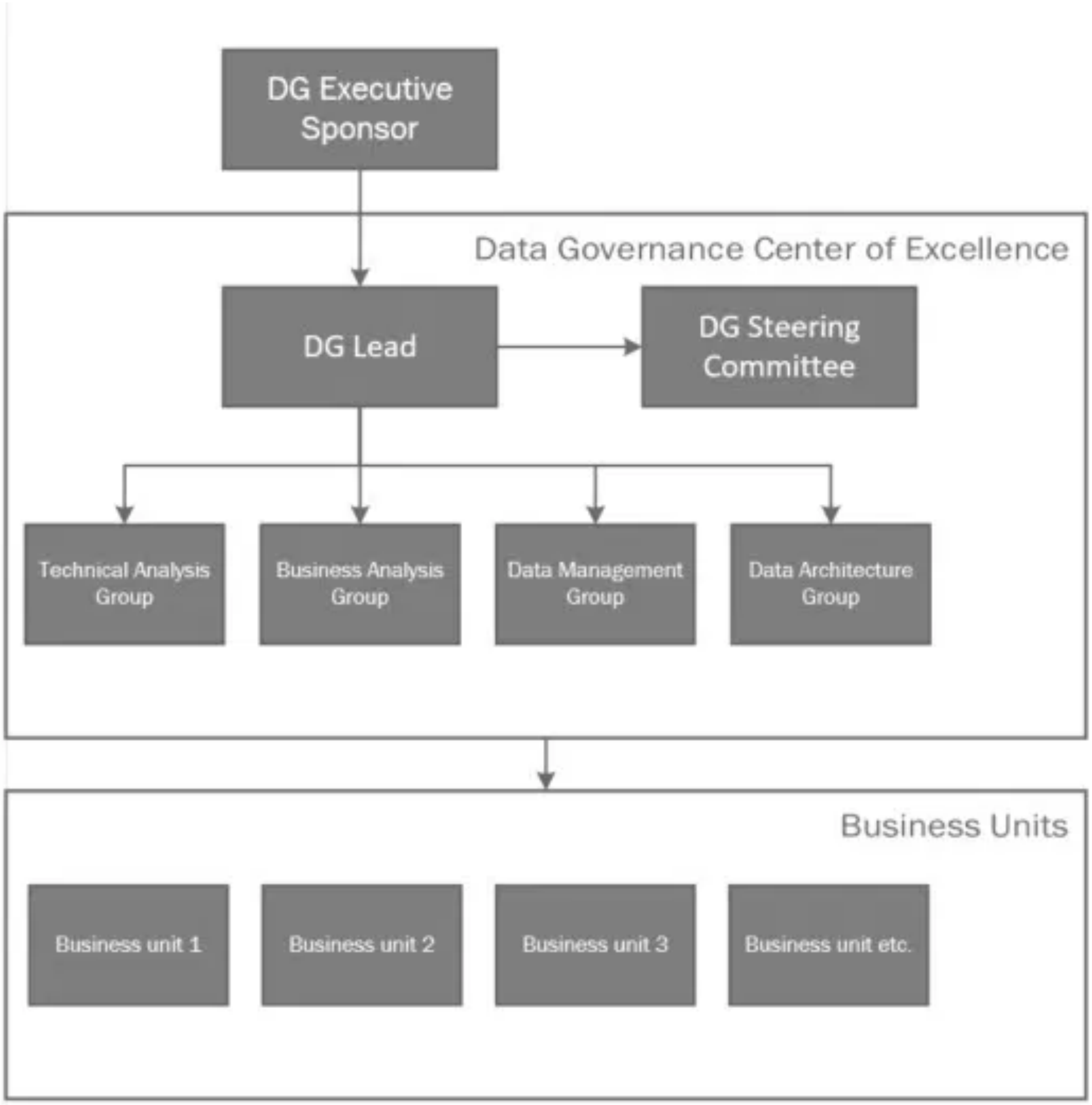
1. Exposing data to the relevant stakeholders as per the agreed upon terms & conditions;
2. Using customizable data transformations for converting external data into the ICONET data model;
3. Provide adequate data security, using proven OAuth2 and encryption techniques.

Furthermore, a data privacy classification paradigm should be followed, in order for sensitive data to be anonymized if a stakeholder in the collaborative cluster deems it necessary, while enabling the functionality given by said data to the ICONET network.

This will allow the functionality of services, such as routing and shipping, to continue to operate nominally while alleviating privacy concerns from the cluster. Finally, apart from having a way to partly automate and facilitate the way that existing collaborative clusters are onboarded in the ICONET, individual logistics providers should be able to also associate with each other and form clusters through the use of the aforementioned service provider.

As such, the service provider will also need to be able to provide functionality for formation of such clusters, acting as the trusted partner interconnecting with ICONET.

Figure 11. Central data operating model.



The arguments pro and contra a central data operating model are shown in Table 25:

Table 24: Arguments pro and contra a central data operating model.

PROS	CONS
Dedicated Data Governance Lead	Incompatible for a more matured data governance program
More efficient decision making	Increased bureaucracy due to the linear structure
Easier to focus on policy, guidelines	Operation rigidity
Easier to control costs	More time required to accomplish data governance operations
Reporting structure clearly defined based on the org chart	Potential loss of oversight over unique and detailed business considerations

The approach which is almost the polar opposite of the central data operating model is the Decentralized data operating model, which has no single data governance owner. In this decentralized data operating model, all decisions and standards are committee-based.

A data governance council is a governing body responsible for the strategic guidance of the data governance program, prioritization for the data governance projects and initiatives, approval of organization-wide data policies and standards, as well as enabling ongoing support, understanding and awareness of the data governance program. A data governance council is also known as data governance steering committee or, data governance advisory group. Regardless of the name, the council tends to have the following roles and responsibilities which are described in Table 26:

Table 25: Roles and responsibilities of the data governance council

Roles & Responsibilities	**Description**
Approval of standards and processes	Some councils are formed at a working level and they are tasked with not only approving standards and processes, but also creating them, at least for organization/ enterprise-wide data.
Goal Setting and performance tracking	The council sets goals for the program, identifies data governance projects and oversees the progress of the program
Internal Communication	The council identifies the data stakeholders and their needs. It assigns data stewards to resolve data issues at the community level. The council serves also as an internal communication vehicle towards the community and promotes the objectives and importance of the governance program. The council also informs stakeholders of decisions, action items, and scope of work determined by the council (including standards, policies, guidelines, etc.)
External Communication	The council advocates the benefits of the data governance program to create awareness, understanding, and financial support. It communicates externally to create a data centric culture.

The arguments pro and contra a decentralized data operating model are shown in Table 27:

Table 26: Arguments pro and contra a decentralized data operating model.

PROS	**CONS**
Relatively flat structure	Reaching consensus tends to take longer
All-encompassing representation from the business	Difficult to coordinate and commit the needed resources from participants
Relatively easy to establish	The committee’s direction can heavily be influenced by those stronger willed

Small communities typically benefit from a centralized structure because the data governance lead would have the capacity to not only wear multiple hats, but be able to learn enough about the business, its environment and challenges to address these issues.
A decentralized model can work well for an organization which has dispersed its operations to several remote locations. As an organization expands, it is usually advised to look into a federated operating model to better support the data governance needs of the organization.

In collaborative ecosystems none of these two traditional models are valid by themselves. This is due to the fact that these are oriented to data governance inside the borders of a company. For collaborative communities a hybrid form of these two models are being proposed, integrating the best of both approaches.

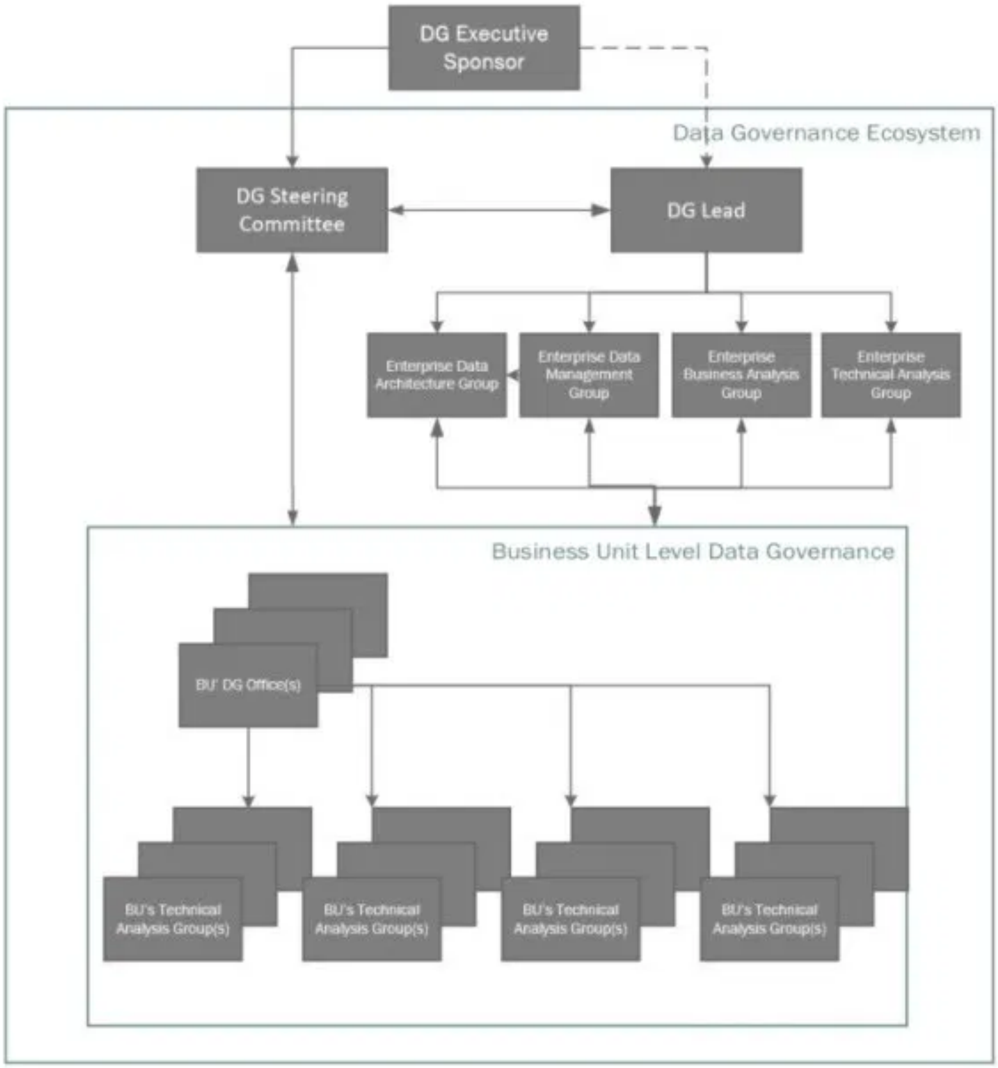
This hybrid or federated model is more suitable for cross-enterprise collaboration, and uses a governance model which operates at the two levels.

On one hand there is still a centralized or decentralized structure at company level, which oversees the enterprise data level for which it has a wide bottom-up input due to the participation from the business units. This internal structure provides a framework, tools, and best practices for the business units to follow, but in theory it also provides the units with enough autonomy to manage business unit specific data and offers channels of influence to gather input for data sets impacting enterprise data or the other way around.

On the other hand, the Data Governance Council, that could be referred to as a Collaborative Data Governance Council, exists, but it is not at company level but at the cross-organizational community level. This data governance steering committee governs and coordinates the collaborative community in terms of data governance.

The consolidation of all the data government structures, both within the organizations and across the different stakeholders, forms the Collaborative Data Governance Ecosystem, which is outlined in Figure 12.

Figure 12. The Collaborative Data Governance Ecosystem



4.2.4 Networked Collaborative Communities - Market Based Pricing Mechanisms.

Under the condition that sufficient data within and across networked collaborative logistics are shared it should become feasible to have a visibility on both supply and demand data for logistics services on a real time basis, which will allow providers of algorithms to define the most cost effective route from origin to destination for all freight in the network.

As a consequence, these providers of algorithms will need to have access to the supply and demand data for logistics services in order to be able to select the most effective route. In an ideal state these algorithm providers should be able to link transport and storage contracts to their proposed routings across different networked collaborative communities in order to have a smooth flow of products through the network.

For this objective it should also be recommended that these routing concepts are integrated into future versions of the incoterms.

4.3 Networked Collaborative Communities - Conclusions

All implementations, which are needed for an evolution from logistics collaboration business models towards networked collaborative communities and the Physical Internet as an end state, are summarized in Table 28.

Table 27: Summary of recommended implementations towards the PI

Implementation	Subsection	Description
Establishment of Open Logistics Networks	4.2.1	- Collaboration between different LSPs. - Collaboration between different PDNs. - Collaborative Corridor Management.
Including Competing and Non-Competing Stakeholders	4.2.2	- Collaboration between competitors.
Open Logistics Standards and Governance	4.2.3	- Standard Modular Shipping Units. - Data Governance Council. - Data Sharing Agreements.
Market Based Pricing Mechanisms	4.2.4	- Dynamic Matching of Supply & Demand. - Dynamic Pricing based on Matching

In order to implement the Networked Logistics Collaborative Communities "the WHAT" to drive efficiencies and CO2 reductions "the WHY", the suggested implementations can be categorized in two different categories.

On the one hand the suggested implementations focus on which parties "the WHO" need to be included in these Networked Logistics Collaborative Communities. It implies here that LSPs and PDNs need to collaborate (subsection 4.2.1) and that this collaboration should imply that competing and non-competing shippers should be able to join a Networked Logistics Collaborative Community (subsection 4.2.2).

On the other hand, the suggested implementations with regards to Open Logistics Standards and Governance (subsection 4.2.3) and with regards to the Market Based Pricing Mechanisms (subsection 4.2.4) clearly refer to "the HOW".

If all these suggested implementations from a business and governance model are implemented in combination with technological developments which have been briefly outlined in Section 4.2, it will be a true breakthrough for the evolution towards the Physical Internet.

5 Conclusions

The objective of this deliverable was to outline the state of the art on business models for horizontal collaboration and networked collaborative logistics communities and also describe the necessary actions and activities that have to be undertaken in order to strengthen the basis for the implementation of the Physical Internet.

As a conclusion we state that the deliverable has met the above objectives.

Chapter 3 described the state of the art of all existing horizontal collaboration business models from the perspective of the stakeholders who are taking the lead in developing these business models (shippers, LSPs, the public sector). The business models have been outlined through explanatory paragraphs and have been complemented with the business model canvas and a process description. To demonstrate that the business models are implemented beyond the Minimum Viable Product (MVP) examples for each of the business models have been given.

Chapter 4 outlined the concept of Networked Logistics Collaborative Communities as an intermediate step in the evolution towards the Physical Internet. In a first section Networked Logistics Collaborative Communities have been defined and the key constituents of the definition have been outlined. In a second section the recommended implementations to get from Horizontal Collaboration Business Models to Networked Logistics Collaborative Communities have been outlined with a focus on stakeholder collaboration (the WHO) and data governance models and financial flows (the HOW).

As such the deliverable provided the necessary insights into both business and governance models for horizontal collaboration and networked logistics collaborative communities, on which the ICONET consortium members can rely to evaluate the Physical Internet concepts they are developing as part of the project.

It needs to be noted that this deliverable stressed the necessity of open, standardized and integrated business models with governance structures in place to evolve from the current horizontal collaboration business model to true networked collaborative logistics communities which will finally result in the implementation of the Physical Internet. This in a strong symbiosis with the technical developments such as IOT and Blockchain which are tackled in other workstreams of the ICONET project.

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