Physical Internet
Efficient Sustainable Logistics

4th INTERNATIONAL
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RTI Capabilities of Air Cargo Transport Chains by Evaluating Processing Interfaces and Actor's Responsibilities

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ACCIA – Air Cargo R&D-Capabilities In Austria

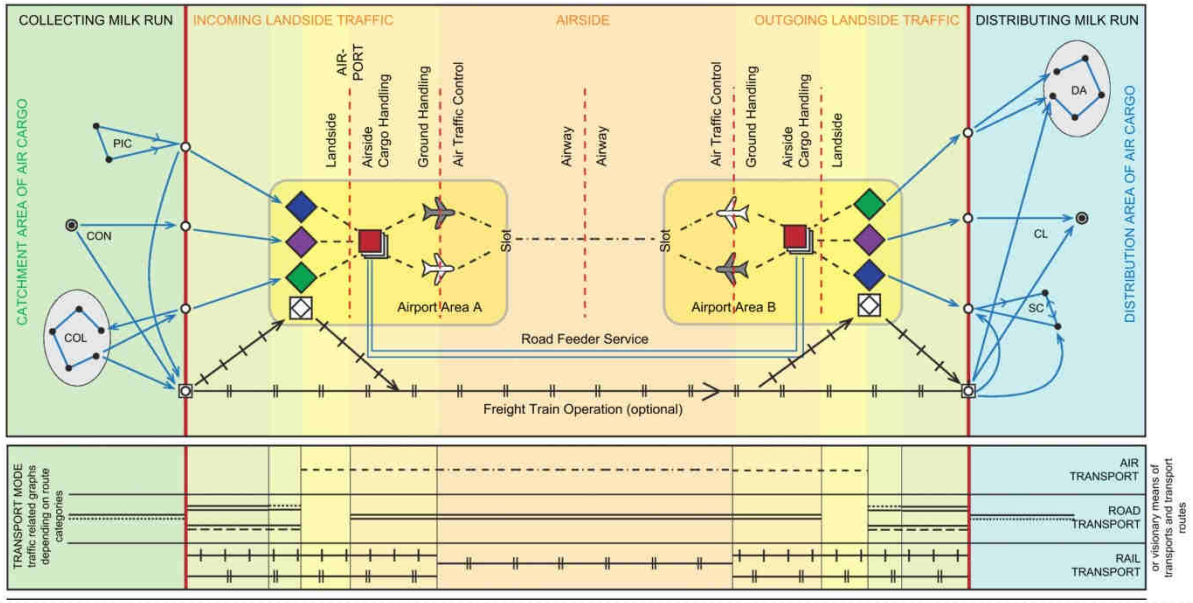
- R&D service for the Austrian Ministry for Transport, Innovation and Technology (BMVIT)
- arp planning.consulting.research DHL GLOBAL FORWARDING VIE Vienna International Airport
- air cargo traffic will be doubled by 2030
- continuous coordination of main carriage, pre-carriage and on-carriage

Overview

- Air cargo transport chains
- Airports seen as locations with potential
- Actors and Functions of an Actor
- Interfaces as a guideline in the process chain
- Interface-Navigator
- RTI potentials in intervention points and fields of application
- Link to the Physical Internet
- Summary & Conclusion

Air Cargo Transport Chains

- Air cargo transport chains are characterised by various actors, a highly competitive market and logistical quality requirements
- Maximum limit for a consignment is the mass or volume transport capacity of an aircraft type
- Global hubs and regional airports



Airports seen as Locations with Potential

- Hinterland potential
- Destination potential
- Location potential
- Factors are to be understood as a gateway to the world especially for regional economies
- Air cargo is not just seen as an Austrian phenomenon -> it is happening globally

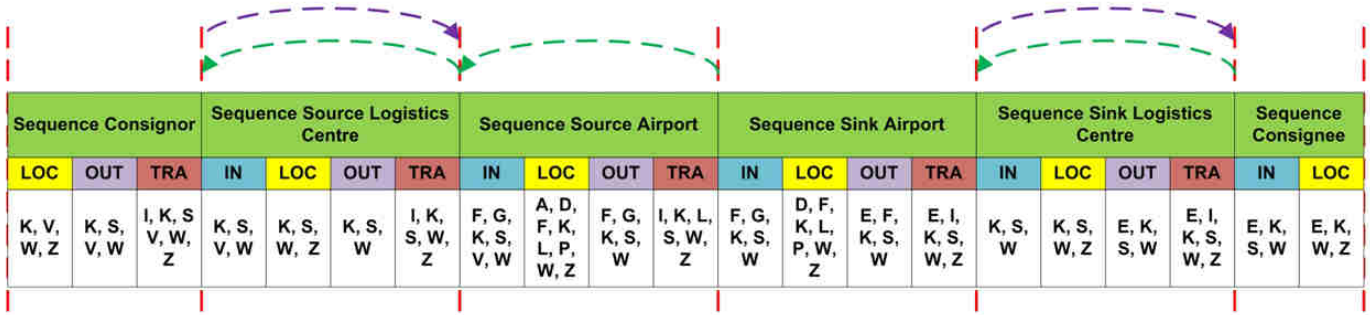
Air Cargo Center Luxembourg as an intermodal interface between landside and airside (Source: LuxairCARGO)

Actors and Functions of an Actor

- Actors involved play roles in different ranges of services
- Function at an interface is not always unambiguous
- Introducing the term "Functions of an Actor"

Functions of an Actor

A	General Sales Agent (GSA) or General Sales and Service Agent (GSSA)
D	Document Cargo Handling Agent
E	Consignee (Empfänger)
F	Airport Infrastructure Provider/Operator (Flughafeninfrastrukturanbieter/-betreiber)
G	Ground Handling Agent *(Operations onto Apron)*
I	Traffic Infrastructure Provider/Operator (Verkehrsinfrastrukturanbieter/-betreiber)
K	recommending/pretending Entity (empfehlende/vorgebende Körperschaft)
L	Airline Company (Luftverkehrsgesellschaft)
P	Physical Cargo Handling Agent
S	Air Freight Forwarder (Luftfrachtspediteur)
V	Consignor (Versender)
W	Further Actors (Weitere Akteure)
Z	Customs (Zoll)



Interfaces as a Guideline in the Process Chain

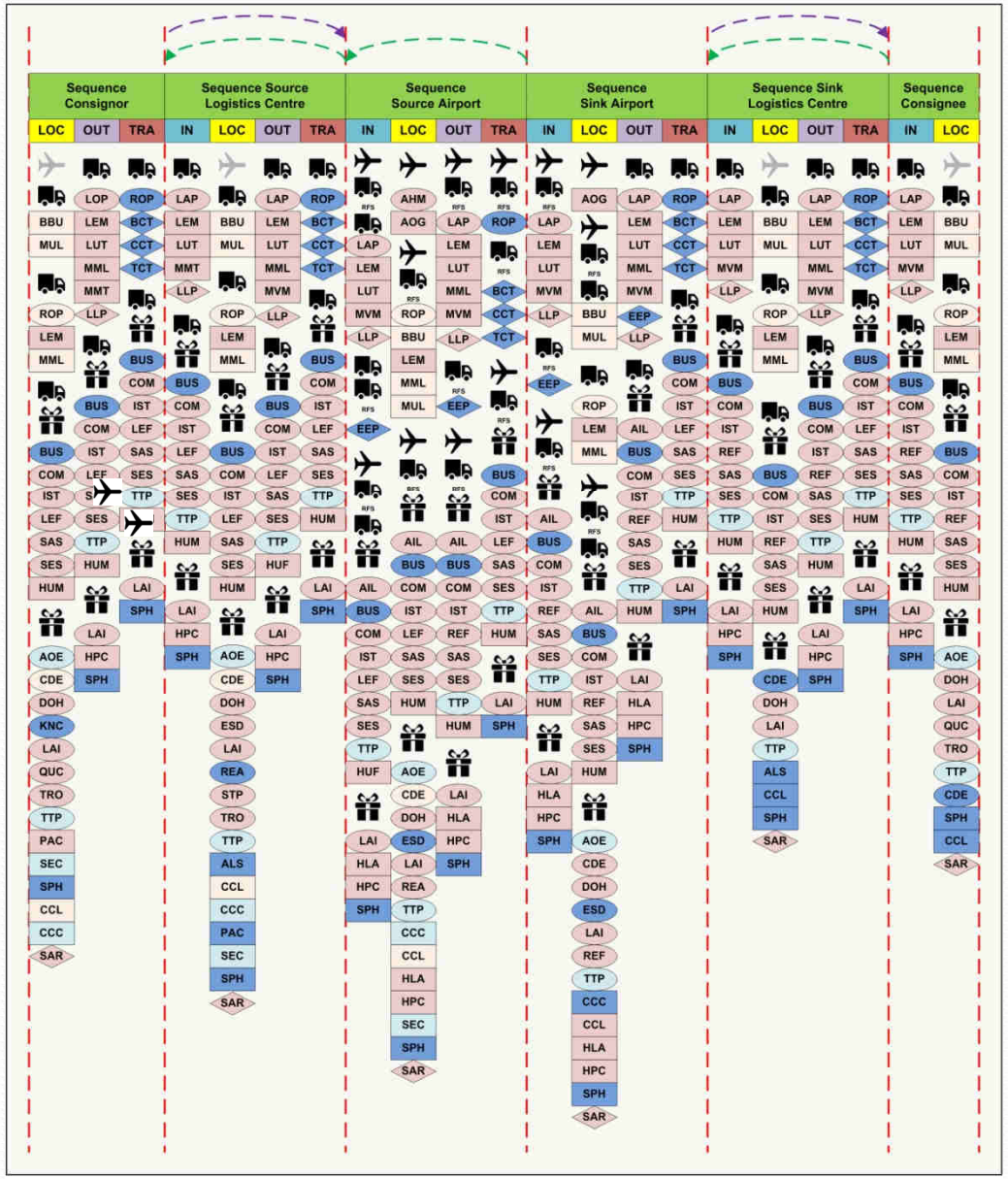
- **Transport geographical view**
- **View of responsibility**
- **View of single sequences**
- **Informational** (data flows of organisational relevance)
- **Infrastructural** (performance features of the available transport infrastructure)
- **Processual** (necessary operating processes based on the consignment structure and the security regulations)

Aircraft-specific ULD construction in ground handling (with kind permission of LuxairCARGO)

informational	**COM - *(IT) Communication*** - *(IT) communication for carrying out the airfreight transport with regard to queries, responsibilities, data provision and so on.* In case of queries, responsibilities etc., (IT) communication is sometimes required for the reciprocal (electronic) transmission of information. Experiences, findings and knowledge (possibly by request) as well as important data for the fulfilment of an air cargo transport chain are thus to be transmitted (hurrying ahead) between at least two actors along an air cargo transport chain. IT communication can also be automated; by setting tracking point an automated message it can be sent to an interested actor.
infrastructural	**LLP - *Loading Area/Loading Ramp/Parking Position*** - *Suitable lorry loading areas/loading ramps or aircraft parking positions with adequate area and amount.* Loading areas and loading ramps are areas or points which are used to load or unload lorries. Parking positions are ground parking spaces for aircrafts, on which the loading is carried out and the aircraft is prepared for the next flight. It is important to provide mutable loading zones, loading ramps or parking positions in order not to delay the loading operations. Situational, spontaneous charging zones (e.g., second lane) may arise due to a high traffic volume or a lack of infrastructure.
processual	**AOG - *Aircraft Operations/Ground Handling*** - *Measures/activities that are directly associated with the landing, take-off and turnaround of an aircraft, as well as indirect activities such as the transport of shipments from the air cargo terminal to the aircraft.* Aircraft operations/Ground Handling include activities that must be executed. These activities can be directly associated with the landing, turnaround or the take off of an aircraft. These include e.g. the clearance of take-off, the landing permission, the push-back, the refuelling, the clear assignment of parking positions or technical checks, as well as the transport of consignments from the transfer station or staging area of an air cargo terminal to the aircraft and vice versa.

Interface Navigator

- **Degree of indispensability** (absolute, absolute-variable, optional, optional-variable)
- **Action-related sequences** (sequence consignor, sequence source airport, ...)
- **Process areas** (inbound, location, outbound, transport)
- **Left out or repeating sequences**
- **Transport modality** (aircraft, RFS, lorry, transport modality consignment, possible ULD service)



RTI Potentials in Intervention Points and Fields of Application

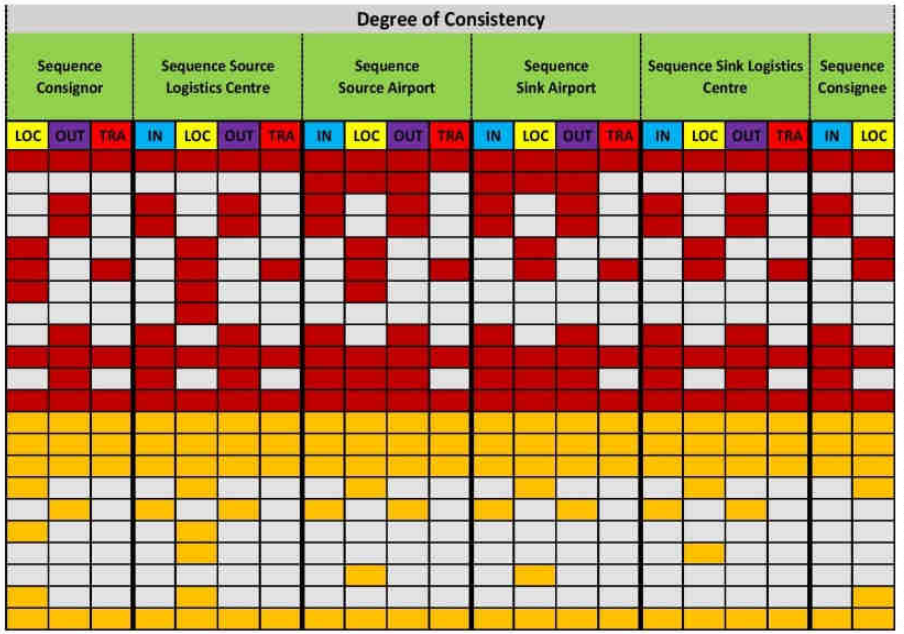
- **Fields of application**
- ***Personalisation*** (all services provided by human resources in the airfreight transport chain)
- ***Formalisation*** (all activities that are used to define tasks and structures or configure processes)
- ***Digitisation*** (networking of objects along the air cargo transport chain by using information and communication technology)
- ***Automation*** *(conversion to automated processes* for the support, facilitation and precision of processes)
- ***Decarbonisation*** (all measures and conversions to encourage post-fossility)
- **Intervention Points** (depending on locations)

Processual interface	Sequences concerned / Process area localisation	Status Quo	R&D-Intervention Points within the Process Chain (selected actions)	R&D-Potentials in application fields				
				Per	For	Dig	Aut	Dek
BBU – Built Up / Break Down of Unit Load Devices (ULD)	1, 2, 3, 4, 5, 6 / STA	-	Action analyses stuffing containers according to flight plans	++	++	++	++	+
			Action analyses built up ULDs according to aircraft load plan	++	++	++	++	+
			Special application of robotics for ULD BuildUp/BreakDown		+++	+++	+++	
			Treatment of goods in export procedures in dependence of climate conditions in their destination´s evironment	++	++	++	++	
			Treatment of importing goods in dependence of their origin	++	++	++	++	
			Technical development of moveable robots for ULD-treatment		+++	+++	+++	

Air Cargo Transport Chains

- High-score summary
- RTI-potential
- Degree of Consistency
- Closer consideration necessary for finding out significance

Ranking	Abbr.	Interface	Plus-Points	Amount Inter-vention Points	Incidence Sequence/ Section
1	HUM	Human Resources	90	10	6/21
2	AIL	Airport Location Selection/Perception	67	13	2/6
3	MMT	Means of Transportation Management	61	7	6/10
4	LLP	Loading Zone/Loading Dock/Parking Position	56	7	6/10
5	BBU	Build Up/Break Down of Loading Tackles/ULDs	52	6	6/6
6	ROP	Route Planning	48	8	6/11
7	SEC	Security Check	43	5	3/3
8	STP	Strategical Transport Planning for Consignments	42	5	1/1
9	LOP	Load Planning	41	6	6/10
10	IST	Electronical Information Technology/-systems	38	7	6/21
	HPC	Handover/Provisioning of Consignments	38	5	6/12
	TTP	Tracking & Tracing (Points)	38	6	6/21
13	SES	(IT-)Security-Systems	33	5	6/21
14	COM	(IT)-Communikation	32	5	6/21
	SPH	Special Handling	32	5	6/21
16	SAR	Storage Area/Room	27	5	6/6
17	LUT	Loading/Unloading of Means of Transportation	26	5	5/9
18	PAC	Packaging	25	5	2/2
19	ALS	Additional Logistics Services	22	3	2/2
20	AOG	Aircraft Operations / Ground Handling	21	3	2/2
21	TRO	Transport Order	19	3	3/3
22	SAS	(IT-)Safety-Systems	18	5	6/21



Link to the Physical Internet

- The Physical Internet is an open, global logistics system based on physical, digital and operational interconnectivity ensured by modularisation, interfaces and protocols (Montreuil, 2012).
- The Physical Internet should optimise the entire transport chain, not just certain segments.
- The developed interface-navigator can be seen as a guideline to serve as a basis for implementing the Physical Internet along the air cargo transport chain.
- The air cargo transport chain could become prototypical for a gradual realisation of the Physical Internet, not least because of the strict safety and security regulations in aviation business.

Summary & Conclusion

- Central research task has been to present the complexities of air cargo transport chains
- Interfaces important basis for implementing the Physical Internet
- Interfaces have to be served by the actors involved
- Functions of an actor were able to be assigned to each interface
- Interface navigator
- Fields of application and intervention points
- Developed interface-navigator, fields of application and intervention points can be seen as a guideline to serve a basis for implementing the Physical Internet along the complex air cargo transport chain

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Freight Transport Service Procurement

state-of-the art and
perspectives in Physical Internet

Mariam LAFKIHI, Shenle PAN, Eric BALLOT
Chair Physical Internet
MINES ParisTech

IPIC 2017

Plan

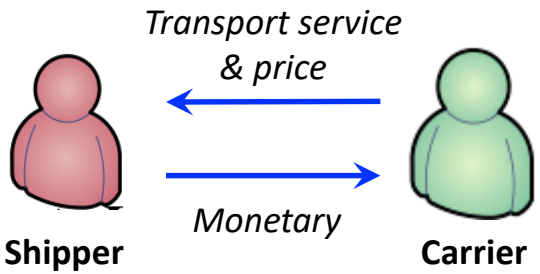
- Freight transport service procurement problem
- Existing mechanisms
- Will Physical Internet change the game?
- Questions & Discussion

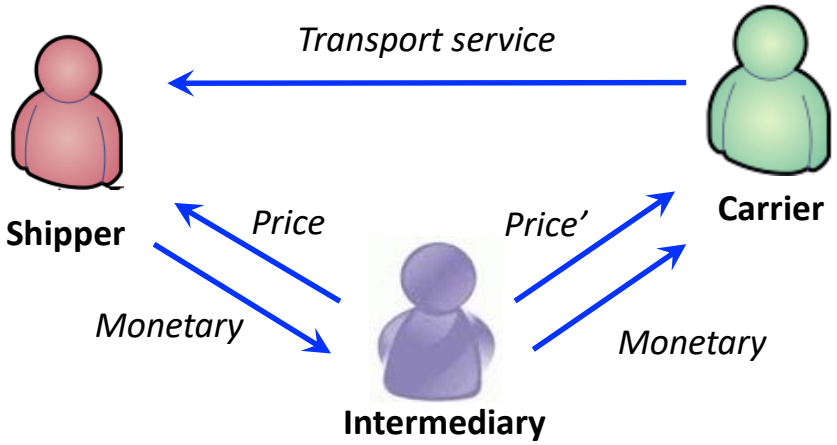
Freight transport service procurement problem

Transport service market

Terms	In freight transport market
Product	Transport service (Transport something from point A to B)
Buyer	Shipper
Seller	Carrier
Intermediary	LSP, forwarder
Market	Marketplaces, online platforms
Mechanism	The way (rules, process…) whereby shippers buy service

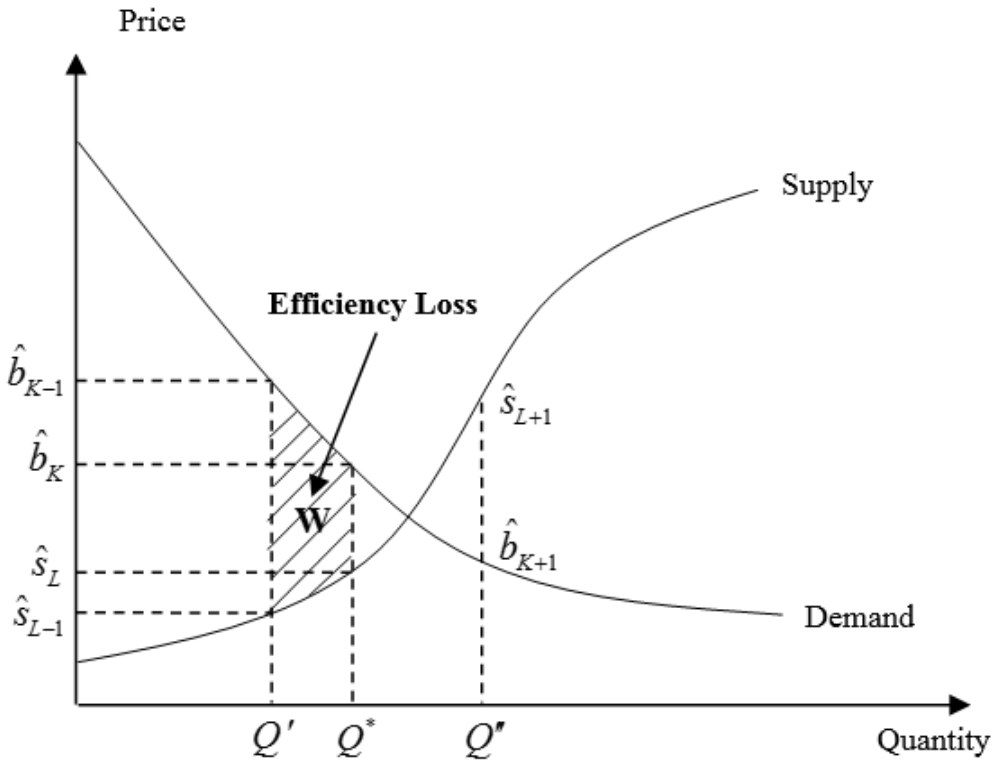
Two Examples





Freight transport service procurement problem

Importance of procurement mechanism



(Xu, 2014) "Truthful, efficient auctions for transportation procurement". Ph.D. Thesis, The University of Hong Kong

Procurement Mechanism will affect

- *Trade quantity*
- *Interest of seller&buyer*
- *Efficiency and effectiveness of market*
  - *Social welfare*
  - *Environmental impact*
  - *Stability of the market*

Motivation to PI ??

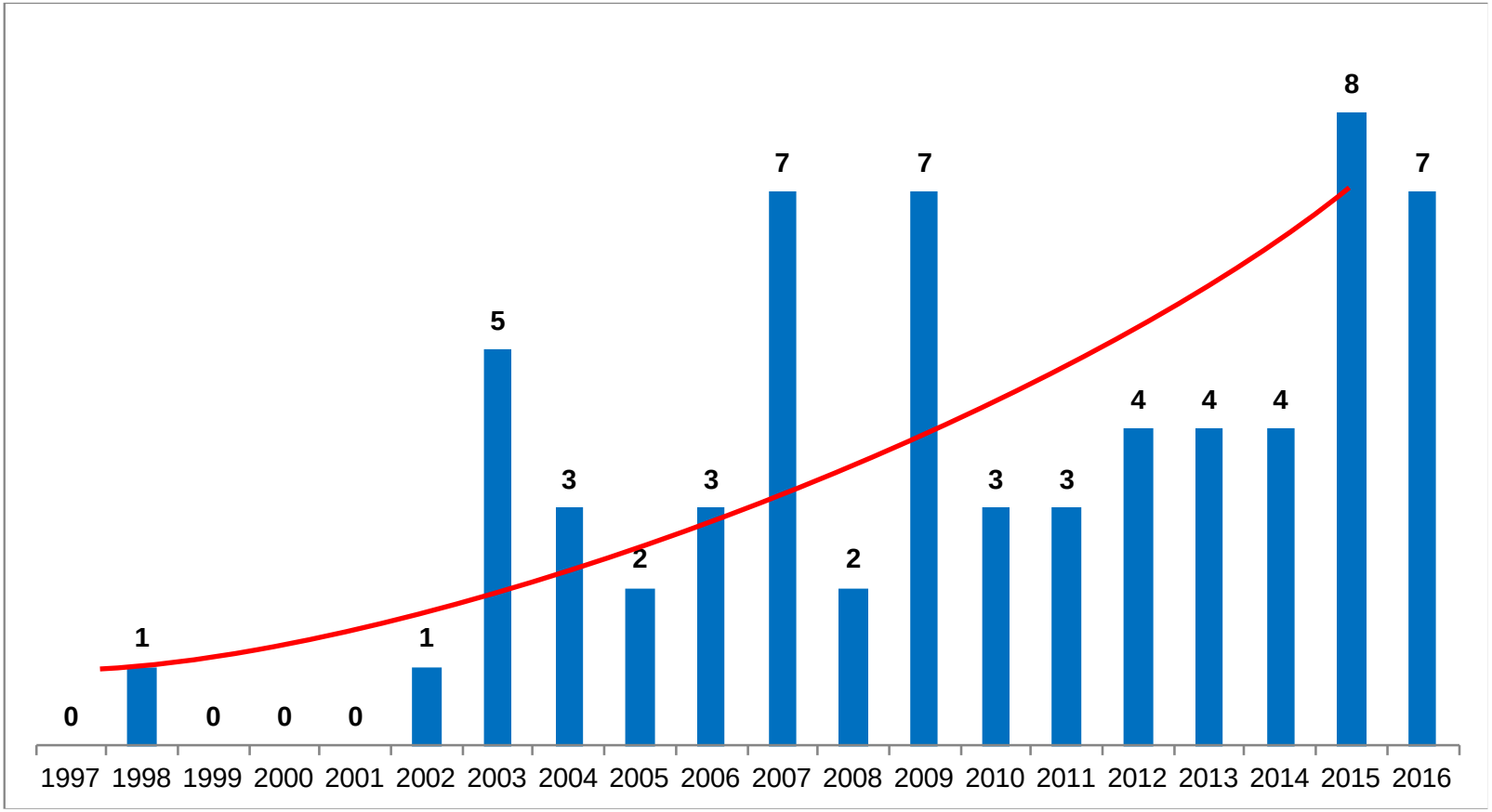
Our interest

find out the effective and efficient mechanisms in favour of Physical Internet

Existing mechanisms: Results and Observation

Literature-based survey

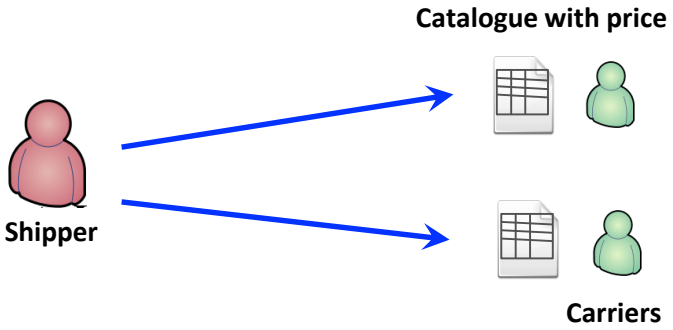
64 articles studying freight transport procurement mechanism problem
(Published from 1997 to 2016, in major journals in SCM)



Existing mechanisms: Results and Observation

○ Three major trade mechanisms studied

- **Catalogue:** ex. SNCF
  - carriers post offers with fixed price
  - shippers select the best options from the market



	Barème général de transport	
	Wagons à 2 essieux	Wagons à plus de 2 essieux ou à bogies
Jusqu'à	€/ Wagon	
60 km	710	1014
70 km	735	1050
80 km	760	1085
90 km	785	1121
100 km	810	1157

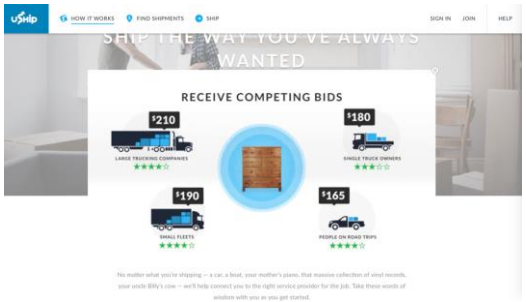
Ex. SNCF's Catalogue

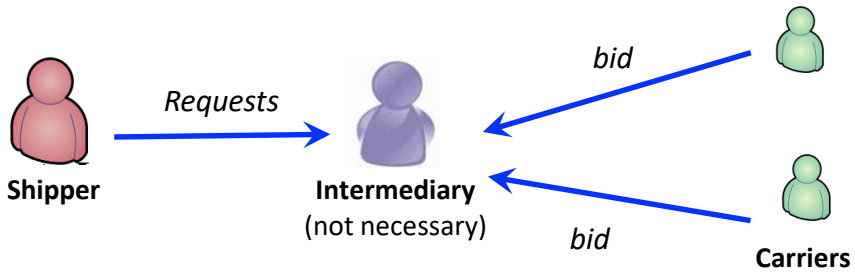
- **Post and search (negotiation):** ex. www.clickandtruck.com, www.getloaded.com
  - carriers post offers, and shippers post requests (with proposed price or not)
  - trade is realised after one-on-one negotiations (but not always)
  - mostly through an intermediary (online platforms, forwarders) → pricing

Existing mechanisms: Results and Observation

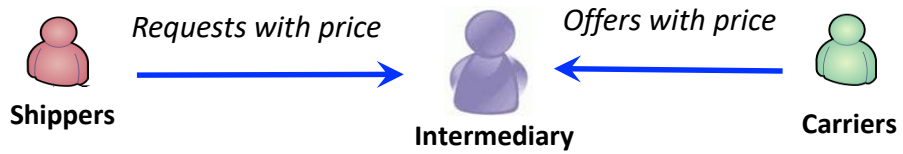
Three major trade mechanisms studied

- **Auction:**
  - **Reverse auction:** ex RFQ (request for quotation), www.uship.com,
    - shippers post requests
    - carriers are invited into a bidding process for the requests





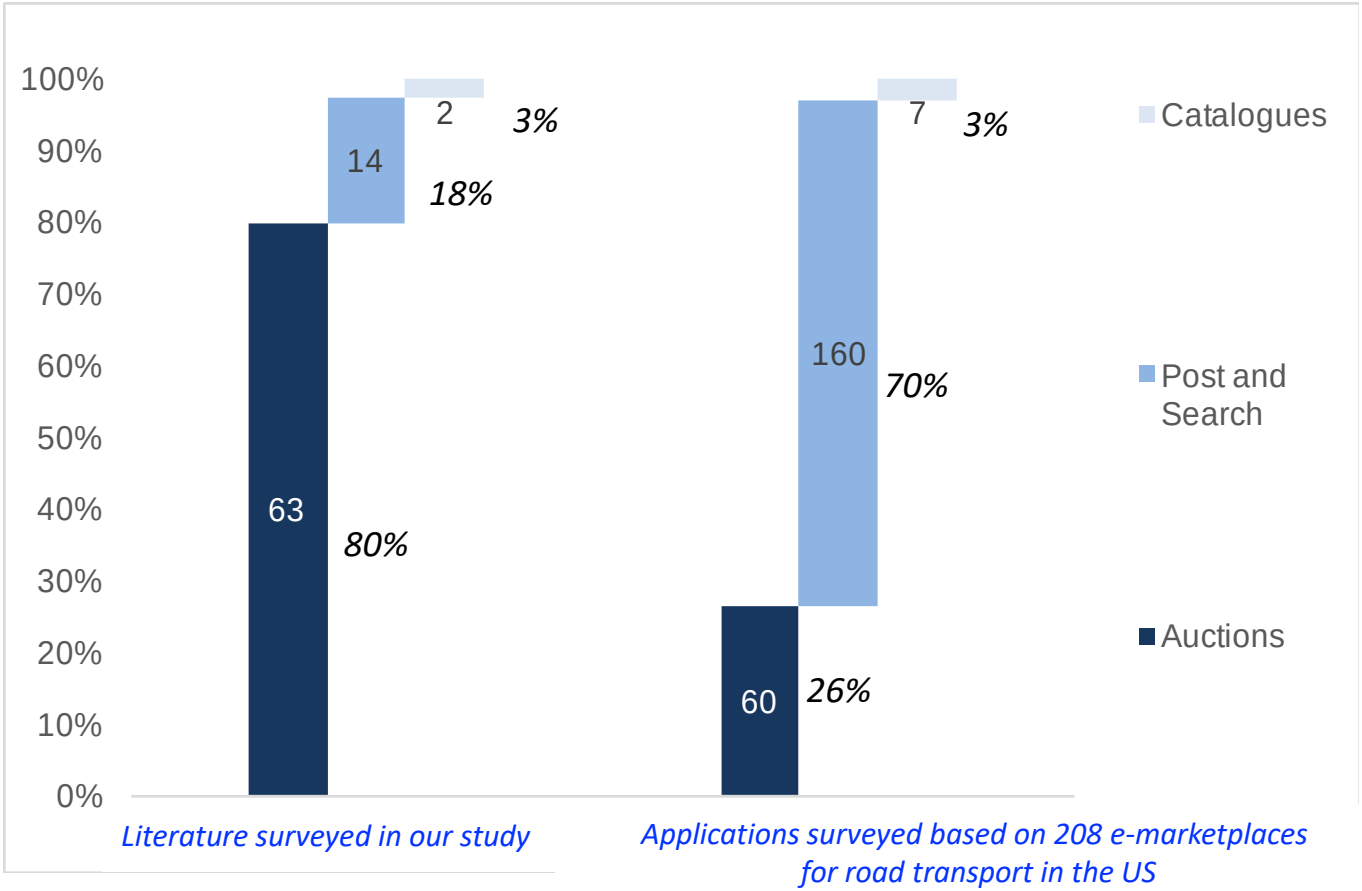
  - **Double auction:** ex. www.priceline.com (not for freight transport)
    - shippers post requests with price
    - carriers are invited into a bidding process for the requests



Existing mechanisms: Results and Observation

Literature *vs* Applications in Practice

Number and percentage of mechanisms studied in literature and in practice



Observations

- Gap of theory/practice
- Post and search
- Mixed mechanisms
  ex. Auction+catalogue

(Collignon, 2016) "Exploratory and Empirical Analysis of E-Marketplaces for Truck Transportation Services Procurement", Ph.D. Thesis, Virginia Tech

Existing mechanisms: Results and Observation

Literature *vs* Applications in Practice

Mechanisms comparison

	Carrier	Shipper	Intermediary	Global efficiency	Implementation
Catalogue	++	++	+	++	+++
Post and Search	+++	+++	++	+	+++
Reverse auction	+	+++	+	++	++
Double auction	++	++	+++	+++	+

* Performance could be different according to market (size, supply vs demands, etc.)

Existing mechanisms: Results and Observation

Literature *vs* Applications in Practice

Other key results from the literature

- **Type of procurement**
  - Spot market (One shot): 30% of the papers
  - Contracts: 70% of the papers
- **Transport mode**
  - Road: 88% of the papers
  - Railway: 2% = 1 paper
  - Maritime: 2% = 1 paper
  - Multimodal: 8% = 4 papers
- **Interest**
  - To individual (shipper/carrier): 50%
  - To market (efficiency, stability…): 50%

Observations

- Auction mainly studied in spot markets
- Lack of study for multi-modality
- Lack of study investigating social interest (congestion, emissions, etc.)

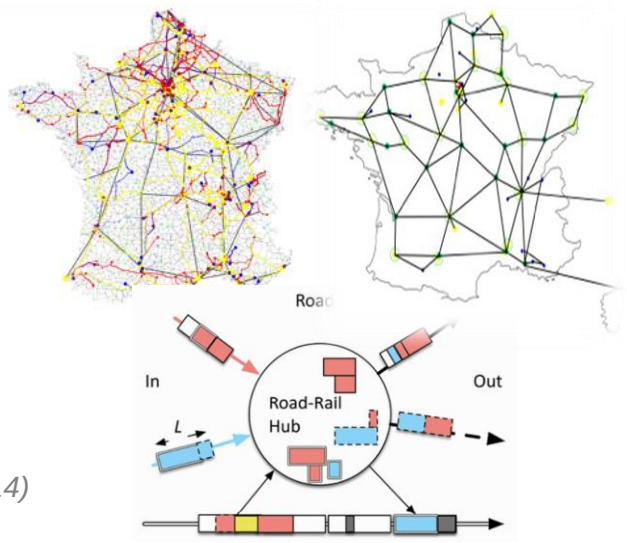
Will Physical Internet change the game?

○ PI-hubs being spot markets?

Physical Internet

- Interconnecting logistics networks via PI-hubs
- Allowing request reallocation at PI-hubs: transhipment
- Being in favour of multimodal transport
- Relying on freight routing
- Many to many open market (hubs)

(Montreuil 2011, Ballot et al. 2014)



Questions raised by PI with regard to service procurement mechanisms

- Who do the pricing? carrier, intermediary, or shipper?
- How to manage interests from individual, market, and society (emissions…)?
- Procurement at different transport level: national, international, intercontinental
- Mechanisms in favour of multi-modal transport
- Mechanisms for many-to-many open system, considering service, cost, and time
- Mechanisms considering collaboration between shippers, between carriers, between indemediaries

Conclusion

Research Purpose

Find out or develop the effective and efficient mechanisms in favour of Physical Internet

Methodology

Survey of the existing theories and practices

Qualitative study: Apply, or develop mechanisms for PI

→ Mechanism design theory

Quantitative study: Simulate the outcome and impact

→ multi-agent simulation models, optimisation models

Expecting impacts

A guideline of procurement mechanisms

Innovative business models for the intermediaries in PI

Collaborative procurement, or routing protocols and standards in PI

Dilemma in logistics…

From LinkedIn