



alice | Alliance for  
Logistics Innovation  
through Collaboration  
in Europe



Towards Zero emissions via

# *Physical internet*

Opportunities challenges & perspective

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Research Fellow P&G, Supply Network Innovation Center

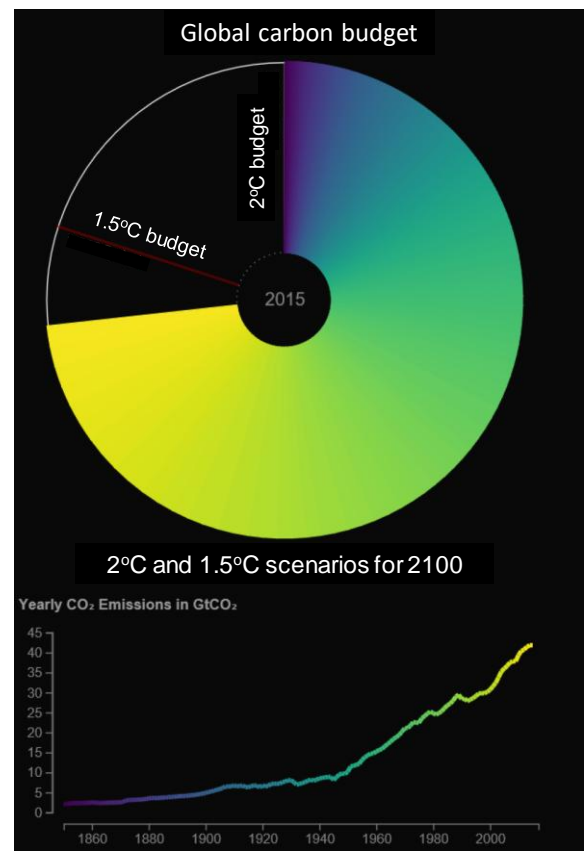


**Sergio Barbarino**  
**ALICE CHAIRPERSON**  
**RESEARCH FELLOW P&G R&D**

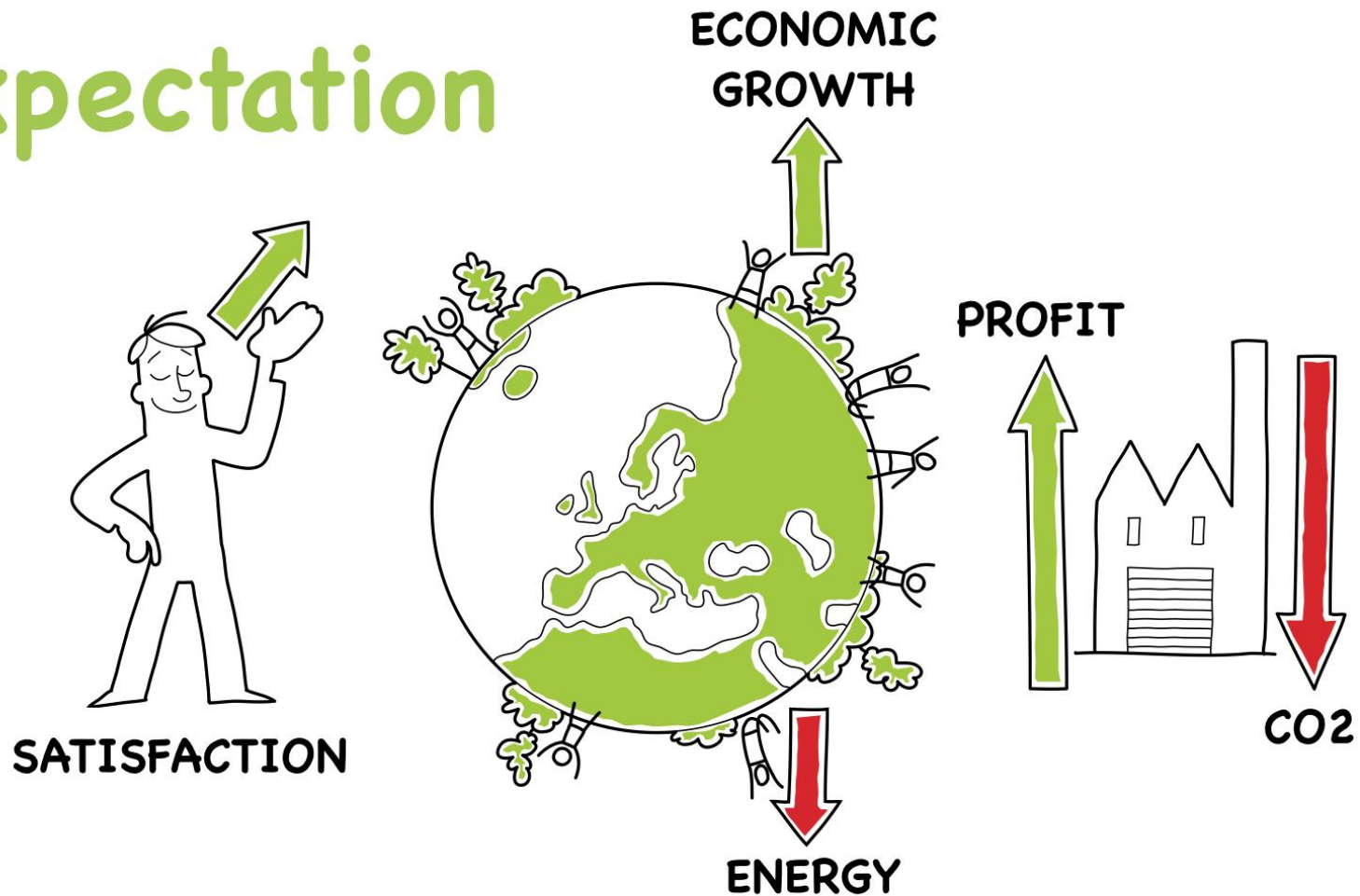
# Michelangelo Lesson



UNFCC COP 21 Conference on Climate Change  
December 2015

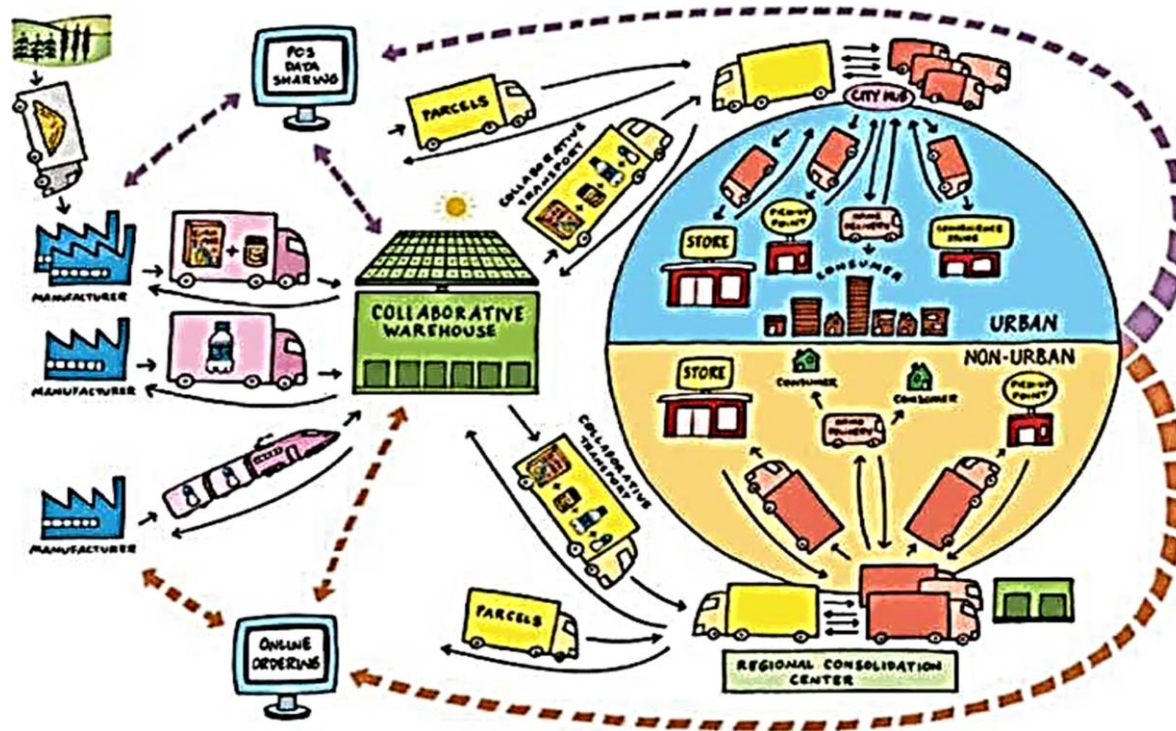


# Expectation



# Logistic & Supply Chain Vision in 2008

Vision for a collaborative supply chain



("2016: The Future Supply Chain" published by the Global Commerce Initiative. (CGI) and Cap Gemini, May 2008)

# WEF 2009 T&L Decarbonization Report

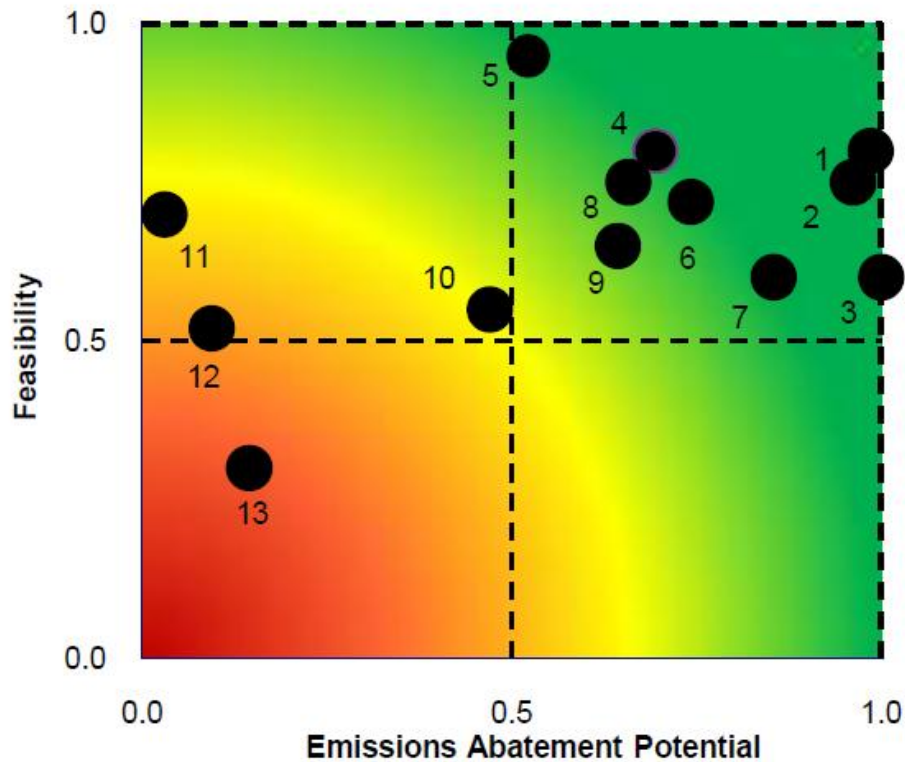
Supply Chain Decarbonization Opportunities	Potential Abatement Mt CO <sub>2</sub> e	Assessed Index of Feasibility
Clean Vehicle Technologies	175	High
Despeding the Supply Chain	171	High
Enabling Low Carbon Sourcing: Agriculture	178	Medium
Optimised Networks	124	High
Energy Efficient Buildings	93	High
Packaging Design Initiatives	132	High
Enabling Low Carbon Sourcing: Manufacturing	152	Medium
Training and Communication	117	Medium
Modal Switches	115	Medium
Reverse Logistics / Recycling	84	Medium
Nearshoring	5	Medium
Increased Home Delivery	17	Medium
Reducing Congestion	26	Low

Base for T&L was 2.8 Billions (ITF base is 3.7)

1.4 Billions potential of which:  
0.5 billions from PI like intervention (arrow)

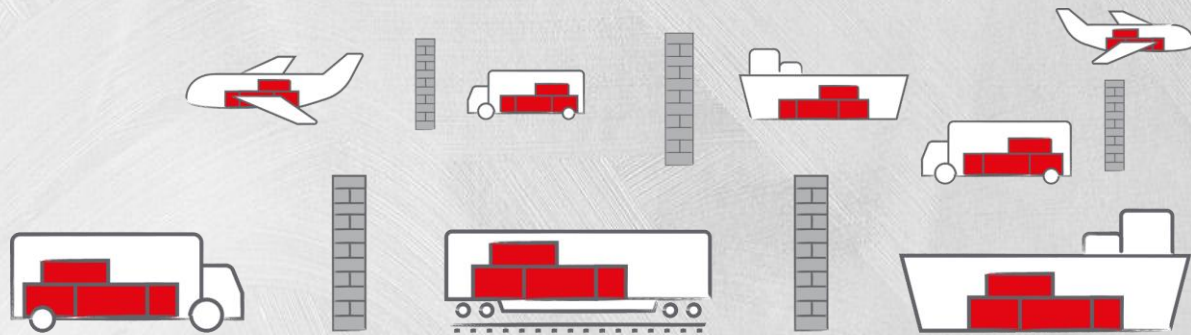


# WEF (effectiveness assessment)

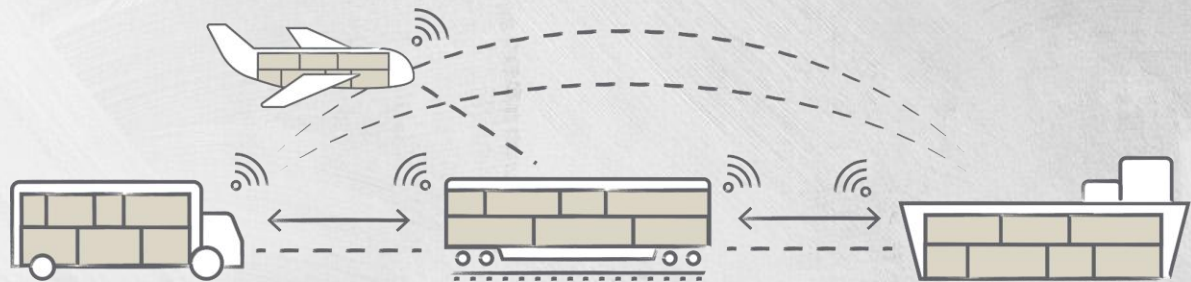


- 1 - Clean Vehicle Technologies
- 2 - Despeding the Supply Chain
- 3 - Enabling Low Carbon Sourcing: Agriculture
- 4 - Optimised Networks
- 5 - Energy Efficient Buildings
- 6 - Packaging Design Initiatives
- 7 - Enabling Low Carbon Sourcing: Manufacturing
- 8 - Training and Communication
- 9 - Modal Switches
- 10 - Reverse Logistics / Recycling
- 11 - Nearshoring
- 12 - Increased Home Delivery
- 13 - Reducing Congestion

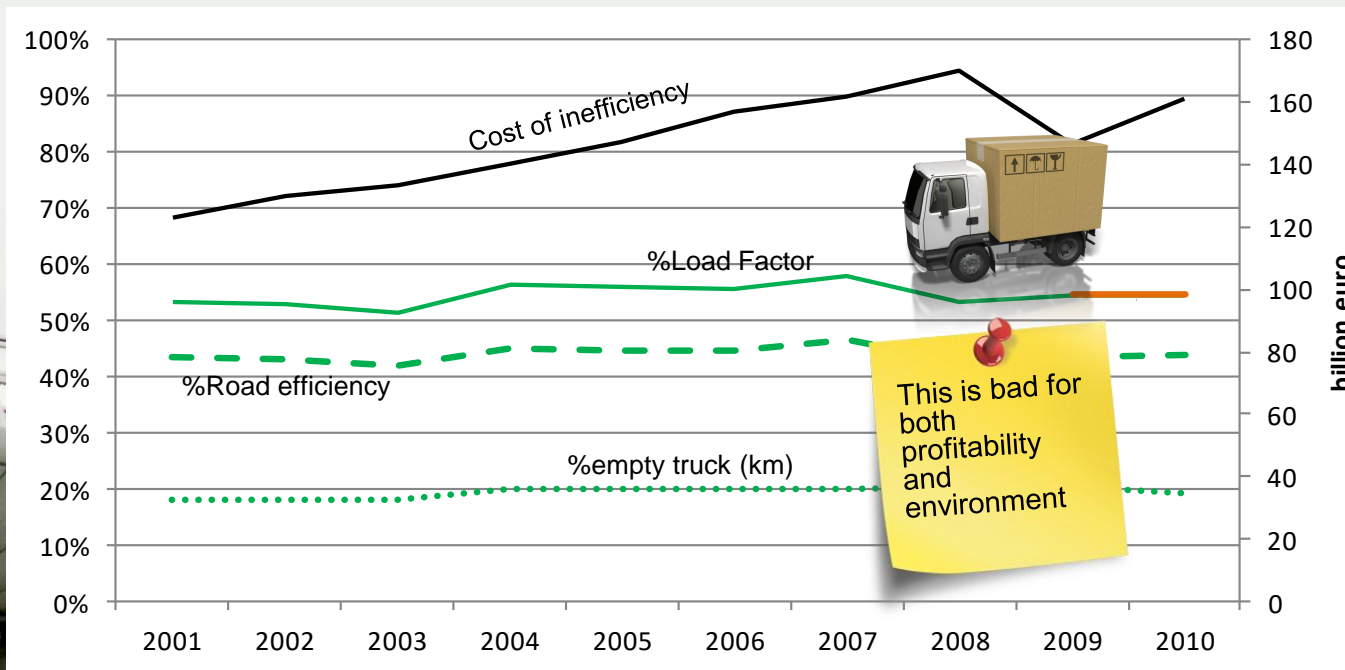




# Challenge



## 10 YEARS: ZERO IMPROVEMENT ON LOAD FACTORS (CO3 Project, FP7)



# Load efficiency is tough if you stay alone

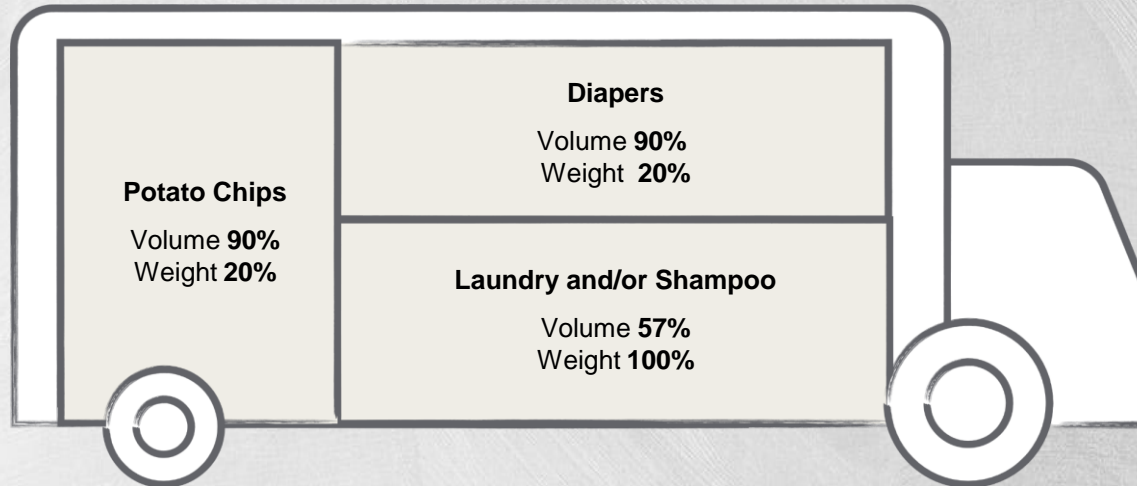


This is bad for  
both  
profitability and  
environment

**Full, but only 25% of  
weight limit**

**60% empty, but at  
weight limit**

## “Cube-Fill” Concept



Container limit: **87m<sup>3</sup>** & **24 tonnes**

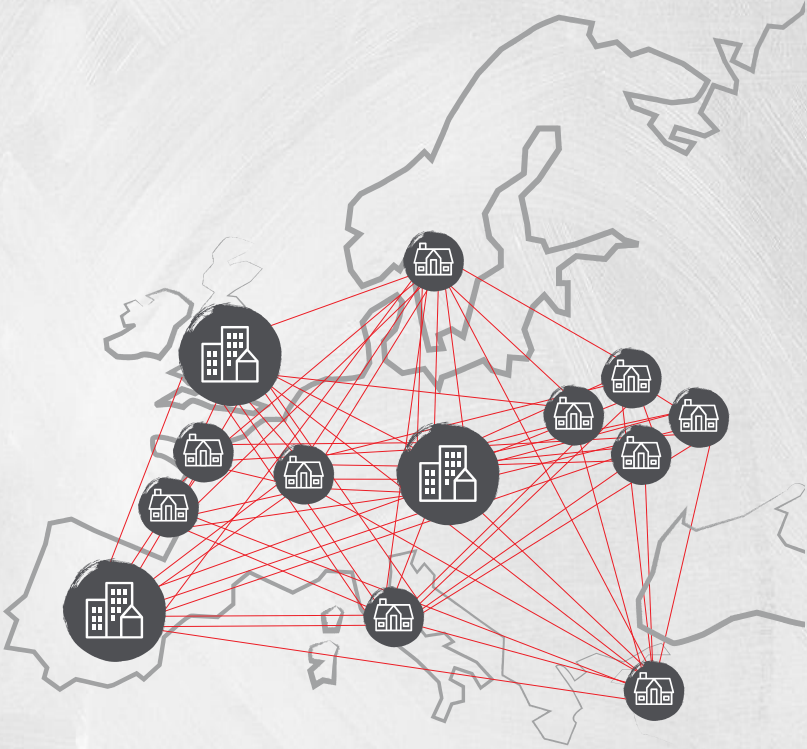
Overall efficiency: **80% weight** & **80% volume**

# “*Cube-Fill*” Concept



Container Limit = 87m<sup>3</sup> & 24 tonnes  
Overall efficiency = 80% weight & 80% volume

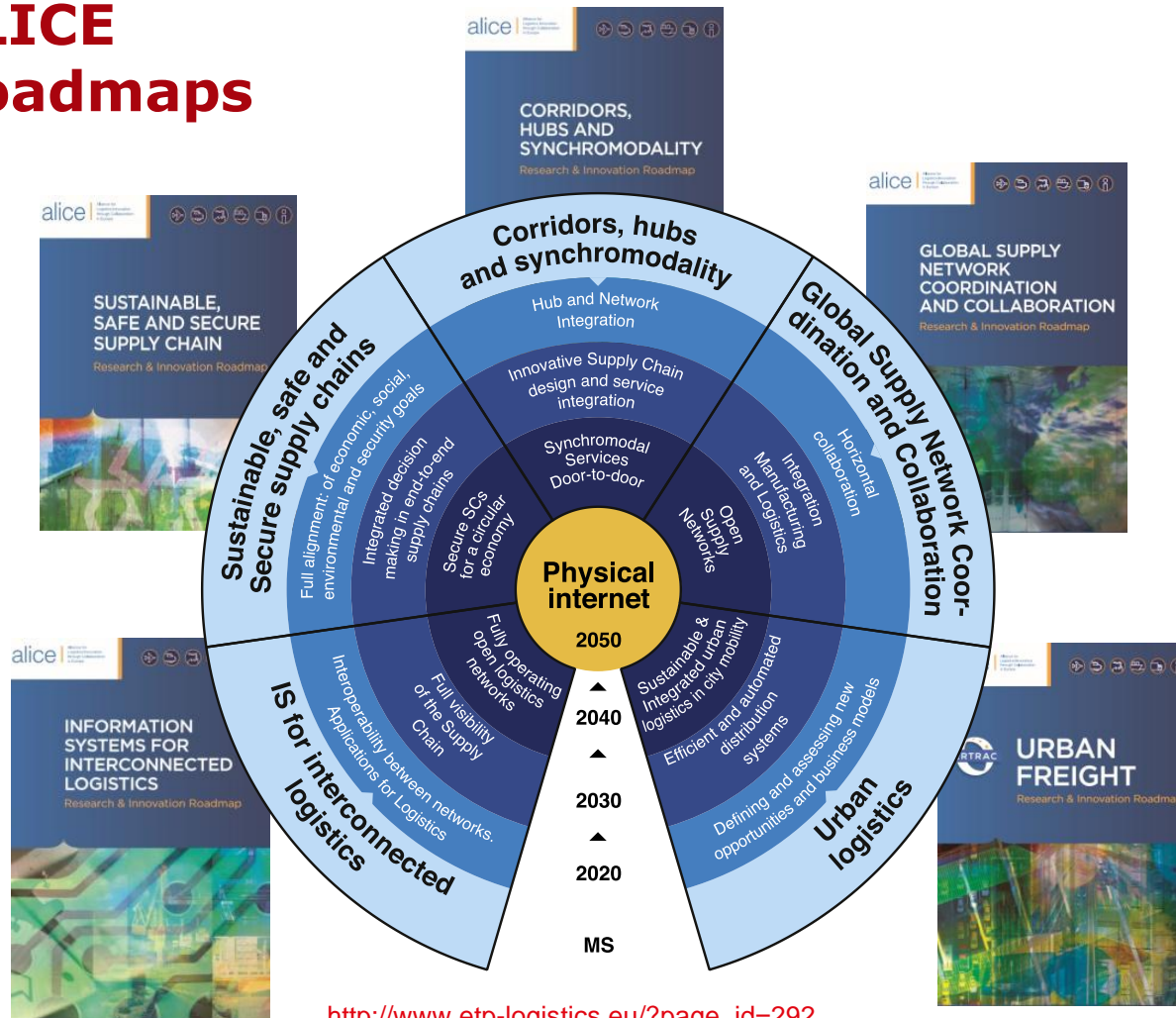
# Dream



# Physical Internet



# ALICE Roadmaps



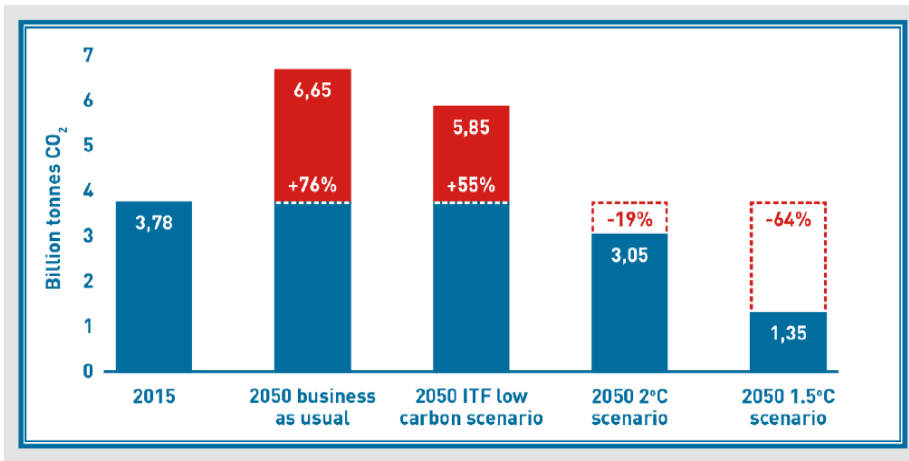
[http://www.etp-logistics.eu/?page\\_id=292](http://www.etp-logistics.eu/?page_id=292)



# UNFC COP 21 Conference on Climate Change

December 2015

UNFCC COP 21 Conference on Climate Change  
December 2015



Smart Freight Centre (2017). Smart Freight Leadership, based on data from ITF Transport Outlook 2017 and SLoCaT 2016

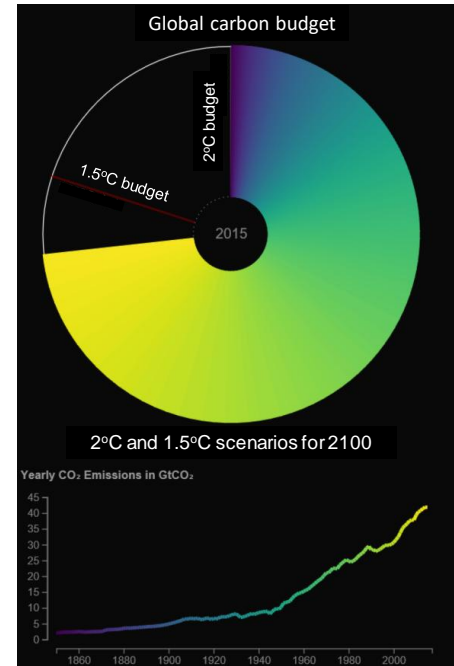
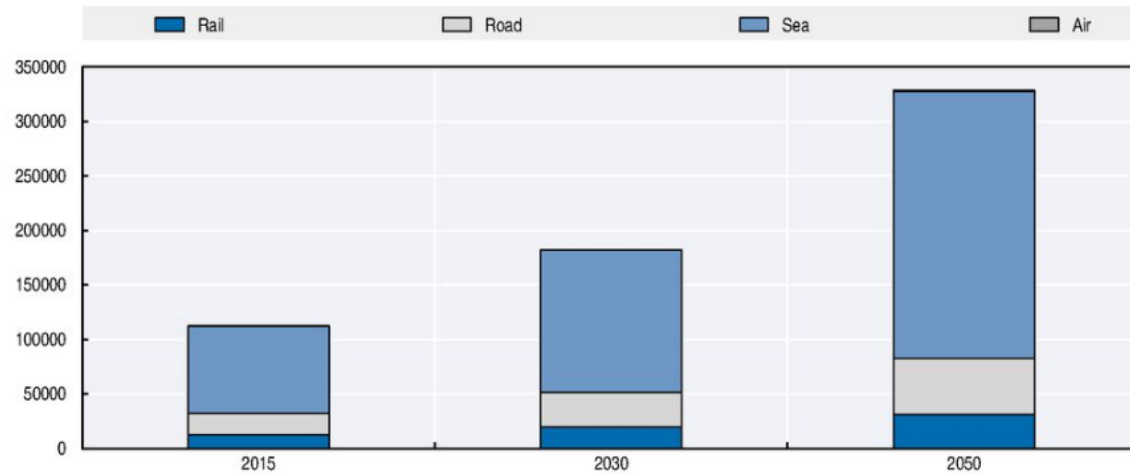



Figure 2.7. **Freight transport demand by mode**

Baseline scenario, billion tonne-kilometres



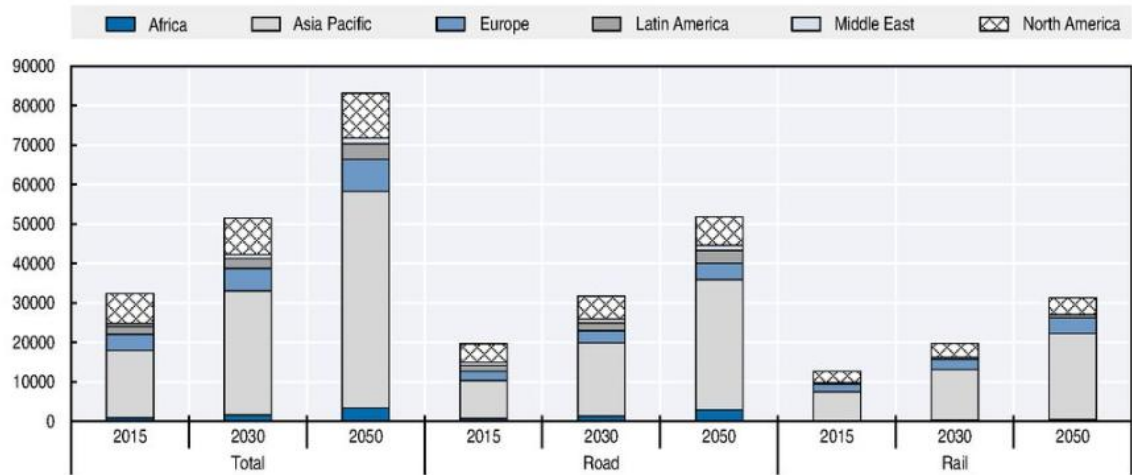
StatLink  <http://dx.doi.org/10.1787/888933442458>


# OECD PROJECTIONS (ITF 2017)

*Total Freight Transport*

Figure 2.8. **Surface freight tonne-kilometres by region**

Baseline scenario, billion tonne-kilometres



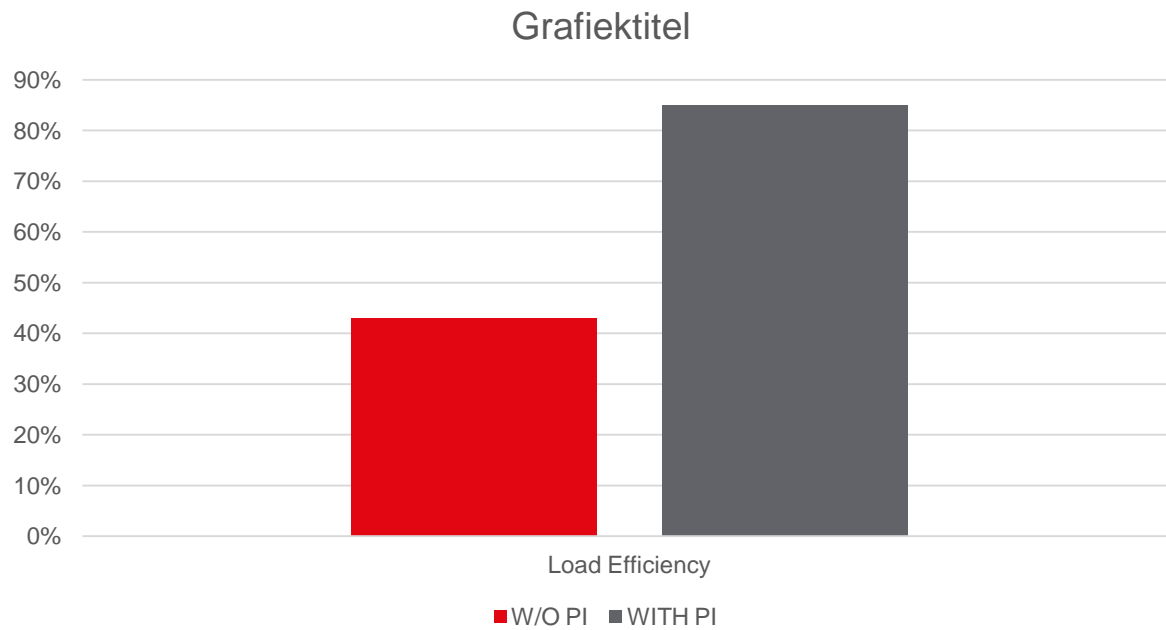
StatLink  <http://dx.doi.org/10.1787/888933442464>

# OECD PROJECTIONS (ITF 2017)

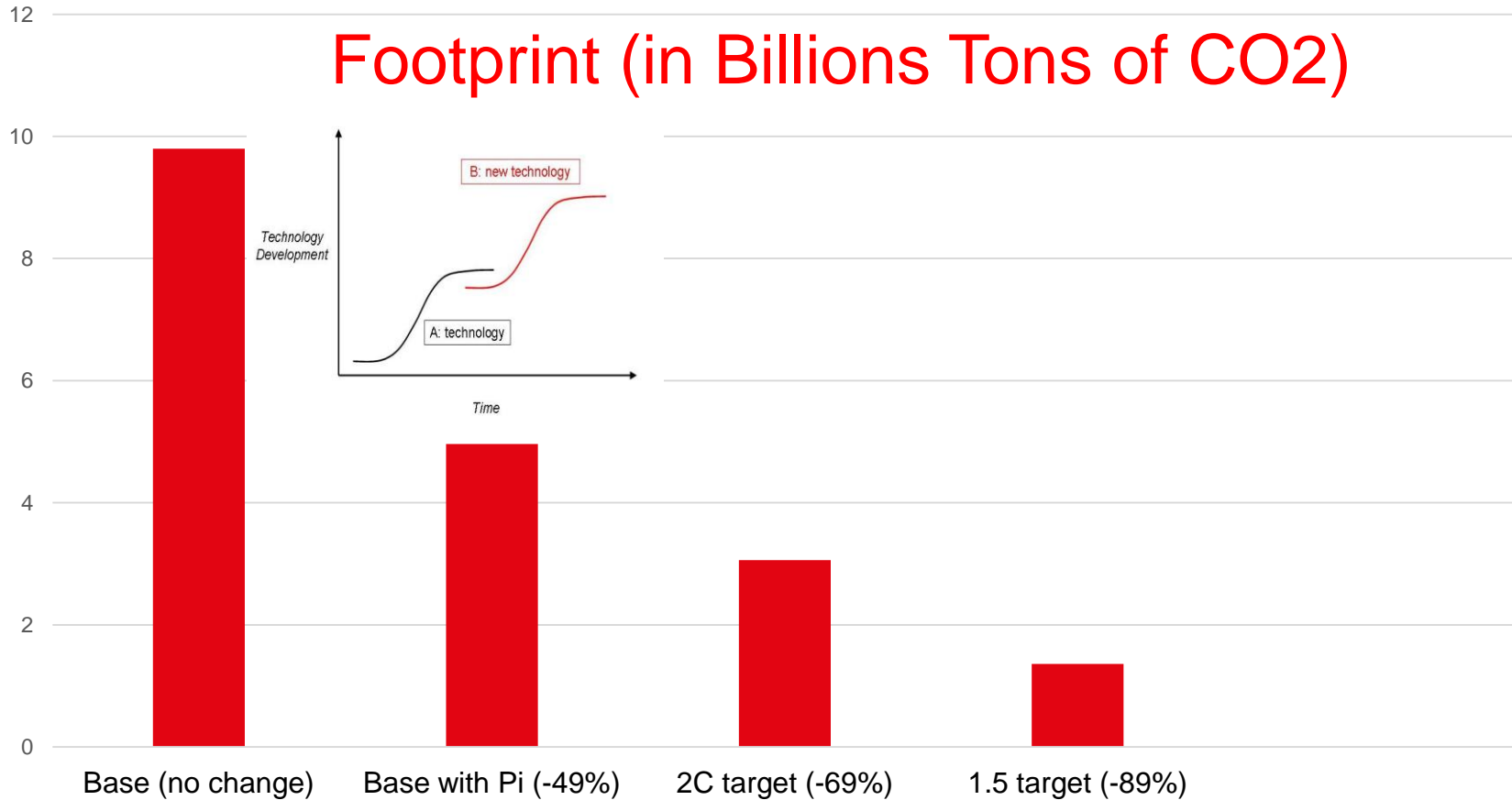
*Surface Transport Only*

# What PI does to the projections?

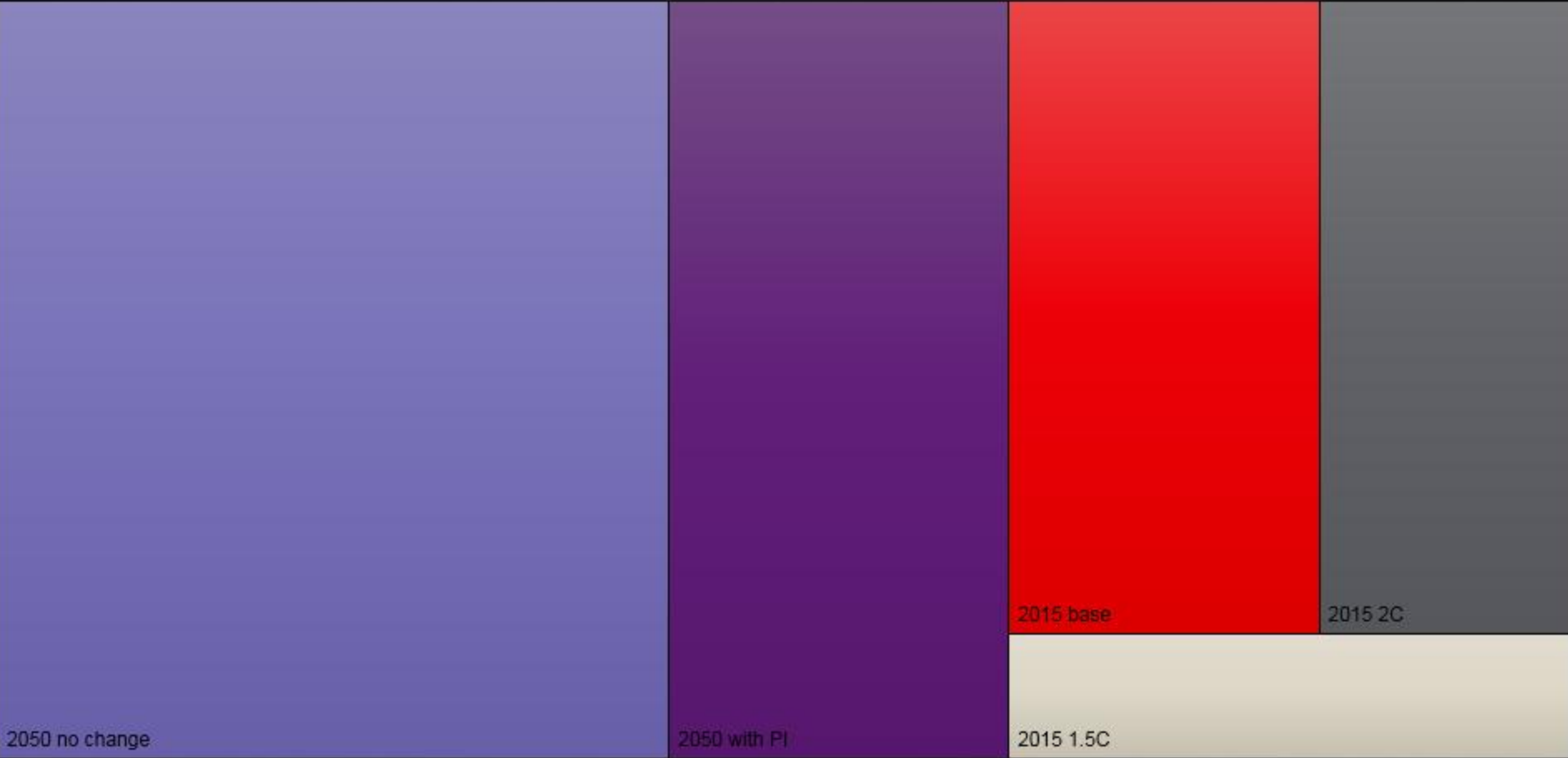
*Let's assume that with PI assets utilization moves from 43% to 85%*



# 2050 Freight Transport Scenarios

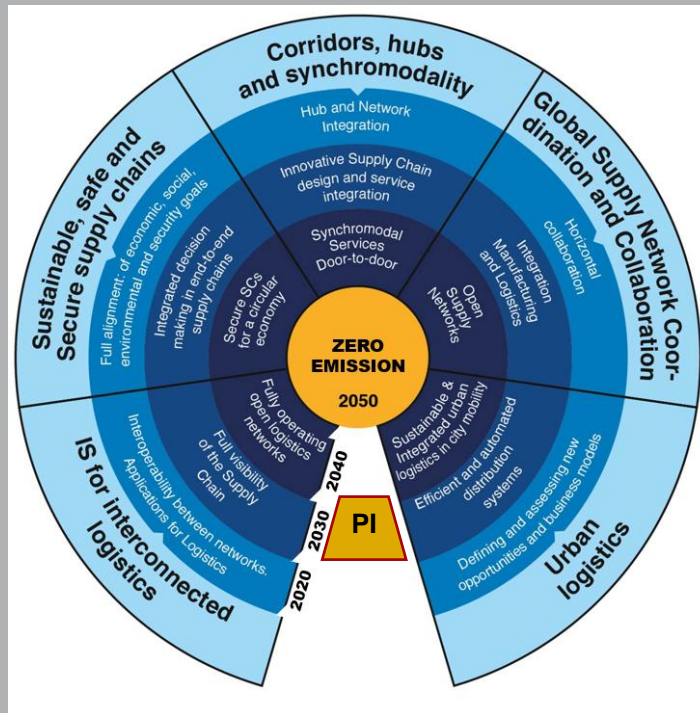


# Carbon Footprint Scenarios



■ 2015 base ■ 2015 2C ■ 2015 1.5C ■ 2050 no change ■ 2050 with PI

## ALICE Roadmap Renewal



**Physical Internet** will bring efficiency and sustainability to Logistics. It cannot fully solve, but it will make it less onerous to meet the **Decarbonization Challenge**.

**We therefore advanced PI realization to 2030 and declared Zero Emissions by 2050 as the new Vision for ALICE**

**Where is the solution?**





# “Cube-Fill” Concept



**But it's not really easy...**

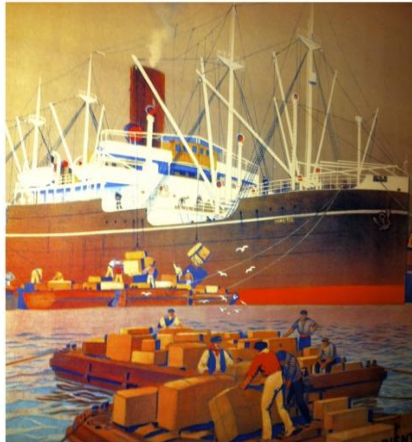


# The key to an open network approach: modules

A generalization of containerization

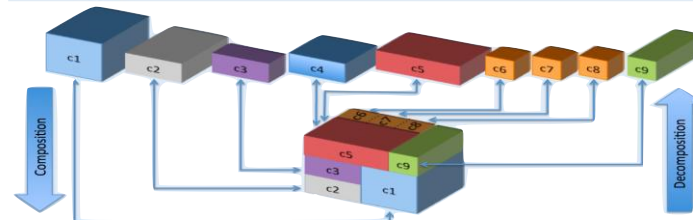
The Box (2006) Marc Levinson, Princeton Press

Cost Port = 2xOcean shipping=2xinland



>>

Cost Port = 0.4xOcean = 0.8xinland



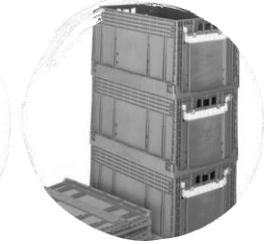
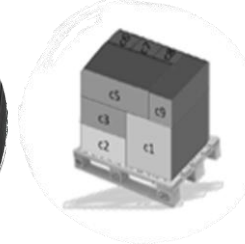
Montreuil, B., Meller, R. D. and Ballot, E. (2010). Towards a Physical Internet : the impact on logistics facilities and material handling systems design and innovation. In: AL, K. G. E. (ed.) *Progress in Material Handling Research. Material Handling Industry of America*

# Modulushca Concept



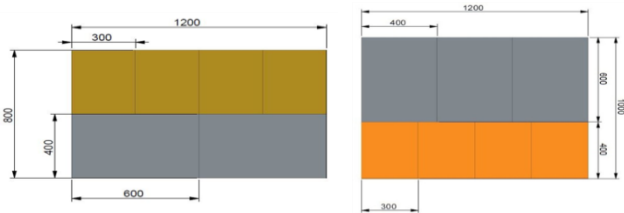
*Today*

*Tomorrow*



**HARD**

RPCs have to be ISO-MODULAR.



EURO pallet type

UK pallet type

RPCs have to have straight walls.

RPCs have to be Stackable up to 2.40 meters.

when they stack, the top of one RPC connects with the bottom of another to prevent the stack from slipping.



RPCs have to have flat inside surfaces.

RPCs must have the capability to have a lid

**SOFT**

RPCs can be foldable as a way to favour reverse logistics. However rigid walls are an option.

RPCs Lid "ability" We don't need to have every RPC with lid BUT RPCs must have the ability to install a lid in case of specific requirements [e.g. Dangerous Goods].



Protection can be realized through one RPC on top at the other and at the top either we put an empty RPC (if we store them in column) or we put a layer lid that will seal the top layer of the pallet (when we created a pallet of RPCs).

RPCs wall thickness reduction is highly desirable in order to increase the inner dimensions.

RPCs should preferably be hermetic. However, in certain applications could have holes in the walls allowing manual handling




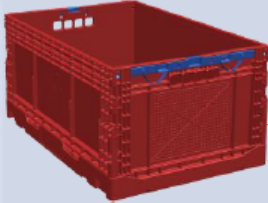

RPCs should preferably be fully interlockable. Interlockability in all dimensions would be desirable.

RPCs should be suitable for direct use as a retail merchandising unit.

**NO**

RPCs must not be nestable.

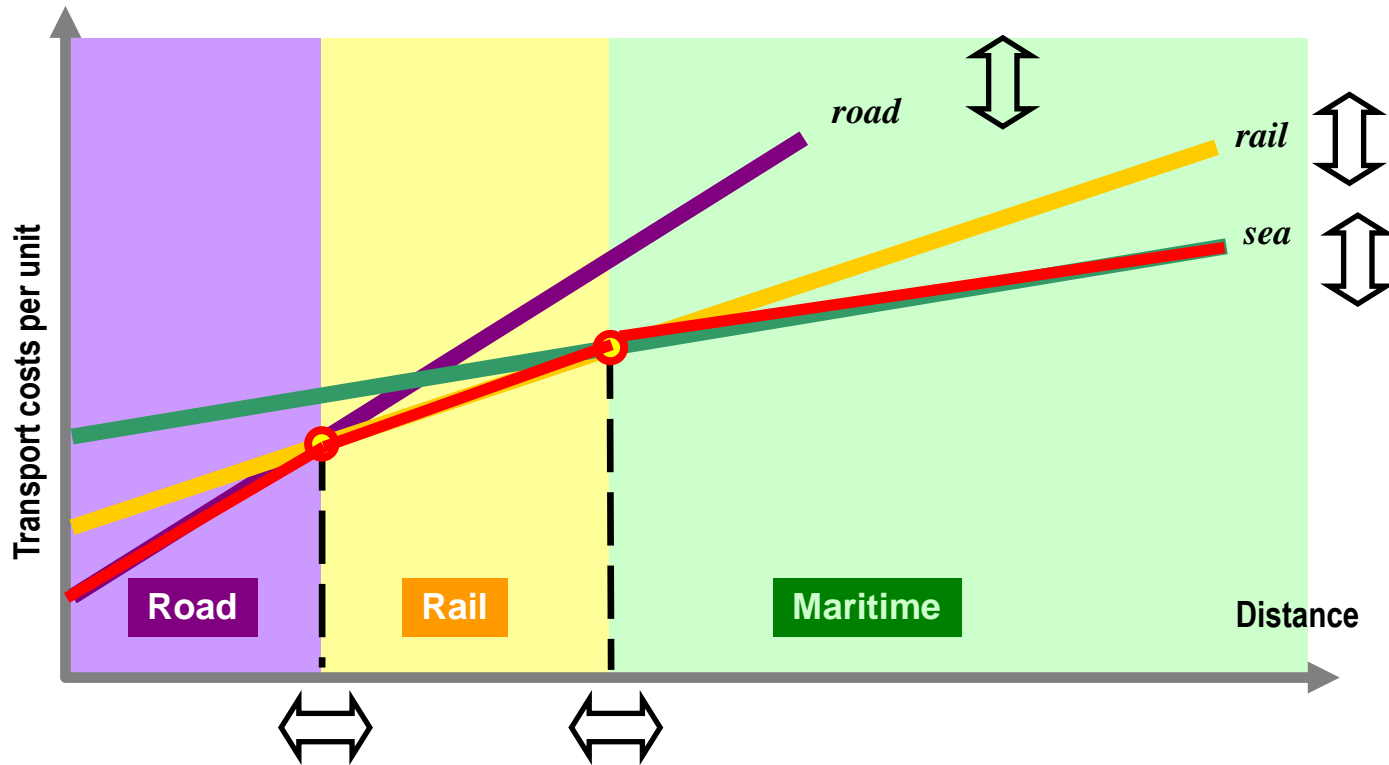


EDEKA	Müller	Rossmann	dm	GS1
Stauchdrucktest 3-er Stapel** 1.200 daN	1.100 daN	1.000 daN	1.400 daN	FEM-Berechnung
Bodendurchbiegung* 30Kg- 5mm Gewicht:3,2 Kg LKR-Boden,10mm	7,5kg – 12mm Gewicht: 2,3 Kg Einfacher Boden,	20kg – 11,3mm Gewicht: 2,8 Kg Einfacher Boden	30kg – 1,7mm Gewicht: 3,2 Kg Doppelboden	Gewicht: 2,7 Kg FEM-Berechnung, Wert zu definieren Doppelboden
				



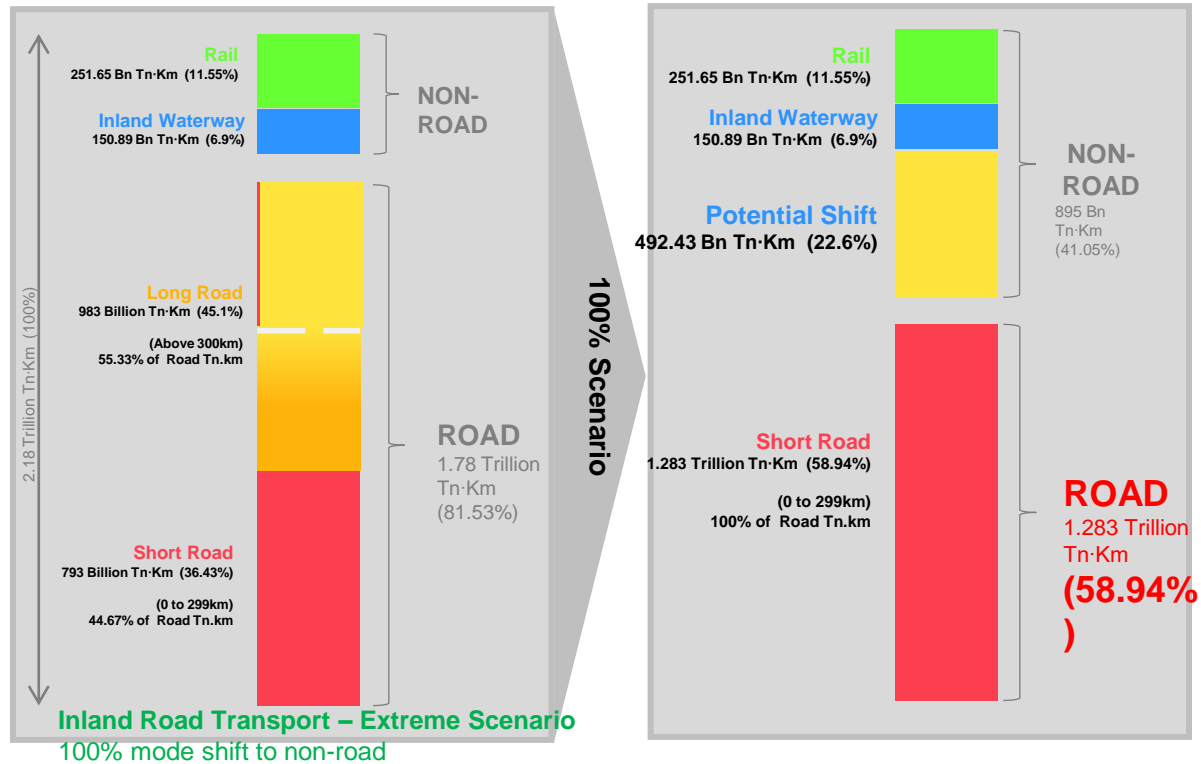
# Clusters 2.0

# MODAL SHIFT





# Modal shift : 40% maximum



**SOURCE:** Eurostat ([rail\\_go\\_typeall](#)), ([iww\\_go\\_atygo](#)) and ([road\\_go\\_ca\\_c](#)) – 2014 EU-28 Data.. For ([road\\_go\\_ta\\_dctg](#)) - Averaged Data from the year 2008 to 2014 and SNIC calculations  
Assumption: Modal shift does not cause increase in the total Tn-km of a journey

# WHY DO WE NEED A CHANGE IN THE INTERMODALITY APPROACH?



## CONGESTION HAS A HUGE SOCIAL AND ECONOMIC IMPACT

### CONGESTION



### IMPACT OF CONGESTION

	COSTS			CO <sub>2</sub>
	DIRECT	INDIRECT	TOTAL	TOTAL
2013	47.3	29.3	76.6	6858
2020	54.9	33.4	88.3	-
2025	60.2	36.9	97.1	-
2030	65.8	41	106.8	7608
% Change	+39%	+40%	+39%	+11%

\* Costs in \$ BN  
\*\* CO<sub>2</sub> in Kiloton Equivalent

Source : CEBR - Cost of Congestion Report

# WHY DO WE NEED A CHANGE IN THE INTERMODALITY APPROACH?



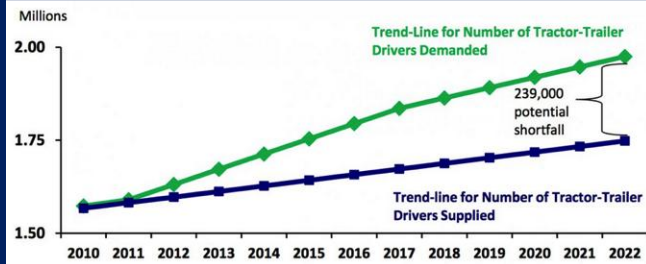
## A DRIVER SHORTAGE IS EXPECTED

250,000 truck drivers, representing 40 percent of Germany's professional truckers are due to retire by 2027, according to a study by ZF Friedrichshafen AG.

Source : Bloomberg, August 2013  
Source : WSJ, November 2012

The US industry is short about 35,000 truck drivers, according to industry lobby group the American Trucking Associations (ATA). The shortfall could grow to around 240,000 drivers by 2020 if it is not addressed, the ATA said.

Source : Reuters, October 2014



## HGV driver shortage is 'a ticking time bomb' for UK logistics sector, say MPs

13/01/2015

Add to favorites



The problems of recruiting younger people into the haulage industry, as a way of solving the driver shortage crisis, was revealed by a new report released by a UK Parliamentary group yesterday.

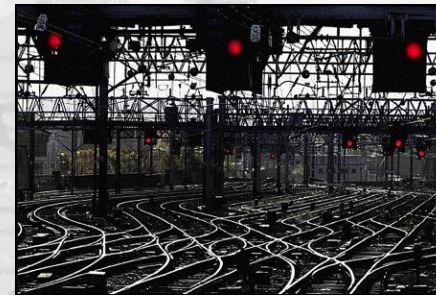
The all-party Parliamentary group for freight transport yesterday published Barriers to Youth

Employment in the Freight Transport Sector, its final report before the country votes in a general election in May, after which the group could comprise different personnel.

# WHY DO WE NEED A CHANGE IN THE INTERMODALITY APPROACH?



## WHILE RAIL INFRASTRUCTURE IS UNDERUTILIZED



	EU 27 - FREIGHT TRANSPORT STATISTICS					
	ROAD			RAIL		
	NETWORK <sup>(1)</sup>	VOLUME <sup>(2)</sup>	INTENSITY <sup>(4)</sup>	NETWORK <sup>(3)</sup>	VOLUME <sup>(2)</sup>	INTENSITY <sup>(4)</sup>
1995	47970	1289	26.9	227139	386	1.7
2000	54719	1519	27.8	217857	404	1.9
2005	62218	1794	28.8	212384	413	1.9
2009	66814	1690	25.3	212693	361	1.7
% CHANGE	+ 39%	+31%	-6%	-6%	-6%	0%

(1) Length of EU-27 Motorway Network in Kilometer  
 (2) Freight volume shipped in EU-27 in Ton-Kilometer  
 (3) Length of EU-27 Railway Network in use in Kilometer  
 (4) Million Ton-Kilometer per Network Kilometer

# WHY DO WE NEED A CHANGE IN THE INTERMODALITY APPROACH?



## WE ARE NOT ABLE TO SET UP AND SUSTAIN INTERMODAL CONNECTIONS

NOT ENOUGH  
CONNECTIVITY



NOT ENOUGH  
VOLUME



NOT ENOUGH  
FREQUENCY



HIGH COSTS



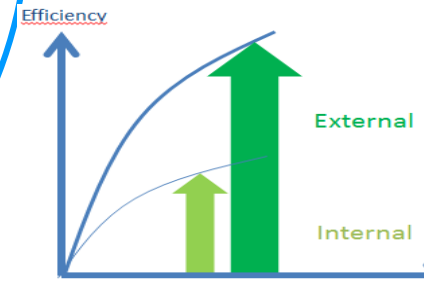
LONG LEAD  
TIMES



 Clusters 2.0

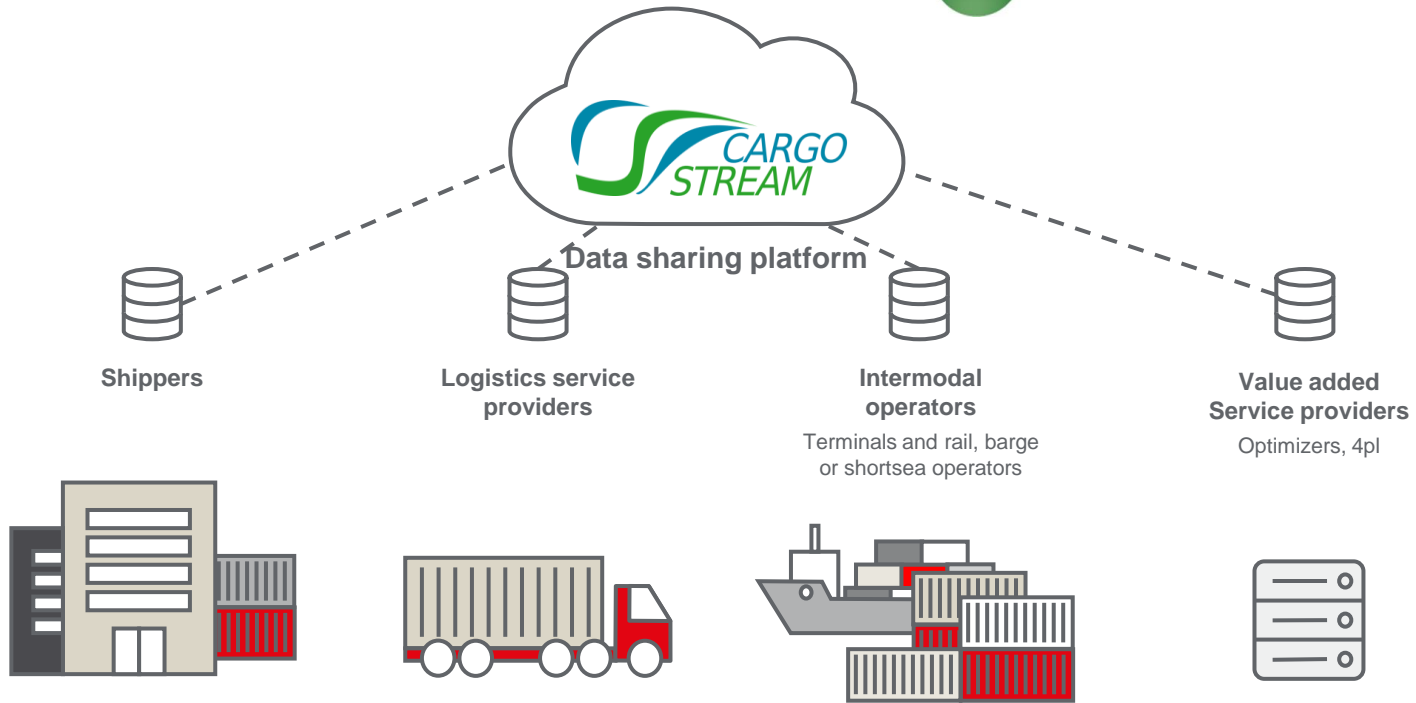


# TRANSPORT COLLABORATION



Making collaboration easy

# Clusters 2.0



## Redesigning Trucks-Trailers for efficiency

# TRANSFORMERS



**VOLVO**

**DAF**  
A **PACCAR** COMPANY

Truck Manufacturers

**SCHMITZ  
CARGOBULL**  
The Trailer Company.

**ECK**

Trailer Manufacturers

**P&G**

**IRU** International  
Road Transport  
Union

End Users



**BOSCH**

Suppliers

**Fraunhofer**

**virtual vehicle**

**TNO** innovation  
for life

**IFSTAR**

**FEHRL**

Research Institutes



UNIRESEARCH

Service Supplier





# TRANSFORMERS Innovation Areas



**Whole Vehicle  
Combination  
Aerodynamics**

**Trailer Mounted  
Electric Driveline  
“Hybrid on  
Demand”**



**Load Capacity  
Optimisation**



## Demonstrator test results

### Hybrid-on-Demand:

3 to 5%



### Aerodynamic features:

approx. 8%



### Loading efficiency:

**Up to 40%**



Motorway: 2 to 4% fuel consumption (FC) reduction

Urban heavy traffic: 6 to 7%

90 km/h constant speed:

Up to 14% drag reduction,

Up to approx. 8% FC reduction

1 additional pallet on floor (3%);  
Double floor: additional floor space;  
+10 pallets = +30% = +16 minutes



## THE ALPHA ALPHA CASE



**ZARAGOZA REGION  
THE BEST  
ALPHA ALPHA GRASS**

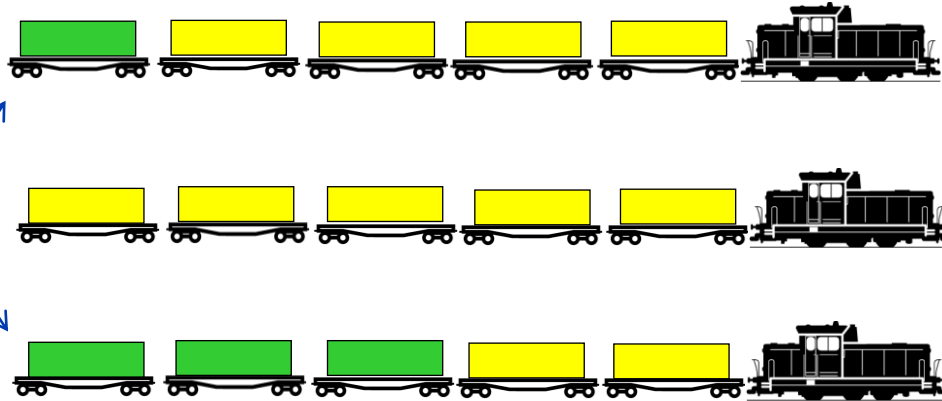


**THE NETHERLANDS  
THE BEST  
MILK COWS**



## HOW DO WE GET THE GRASS TO THE COWS?

ALPHA ALPHA LOADS  
ARE NOT URGENT  
AND USED  
AS A FILLER



ALPHA ALPHA GRASS LOAD



REGULAR LOAD



## FROM A ONE LEAD TIME MODEL WITH PLANT STOCK

CURRENT SUPPLY CHAIN SET-UP			
PRODUCTION	PERIOD N	PERIOD N+1	PERIOD N+2
PLANT INVENTORY			
FAST AND AGILE TRANSPORTATION MODE			

## TO A MULTIPLE LEADTIME MODEL WITH PIPELINE STOCK

SYNCHROMODAL SUPPLY CHAIN SET-UP			
TIME	PERIOD N	PERIOD N+1	PERIOD N+2
PLANT INVENTORY			
FAST AND AGILE TRANSPORTATION MODE			
FAST AND STABLE TRANSPORTATION MODE			
SLOW AND STABLE TRANSPORTATION MODE			



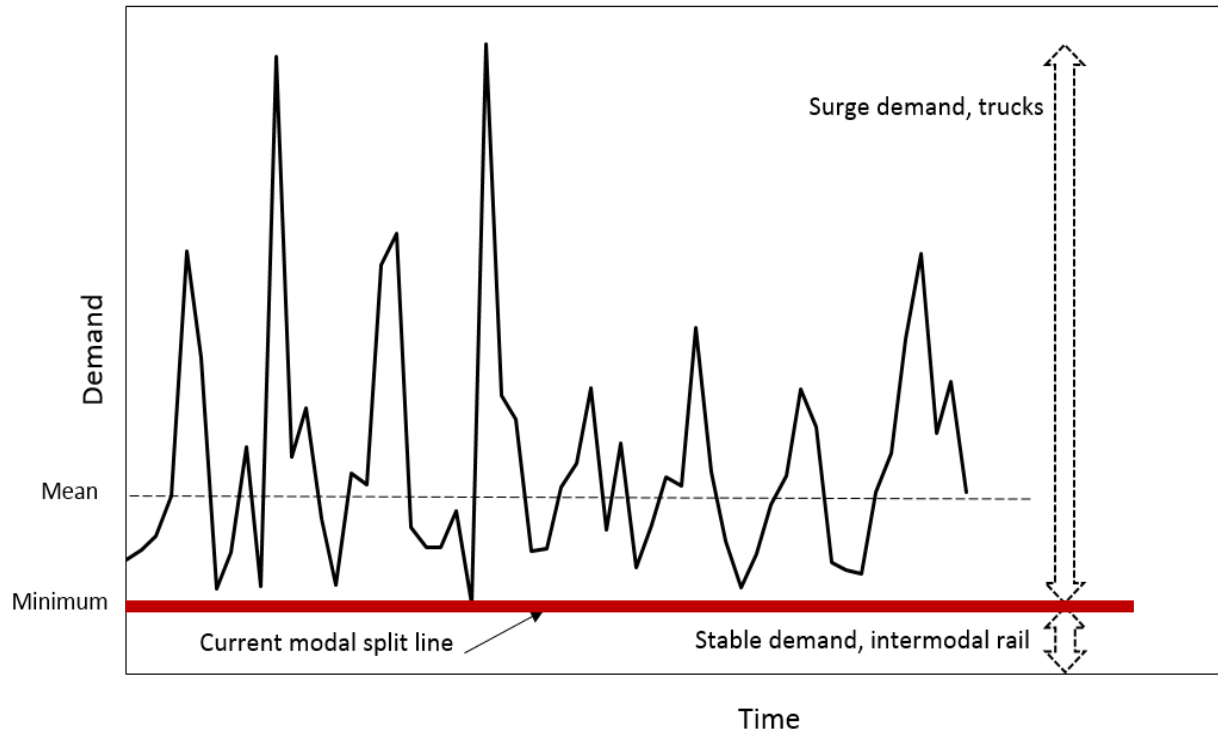
## **BENEFITS OF SYNCHROMODALITY.**

- ❖ Reduction in transportation cost if slow mode is used for non-urgent volume (40% of total volume).
- ❖ Reduction in warehousing cost due to the shift from warehouse inventory to pipeline inventory.

## **PREREQUISITES FOR SYNCHROMODALITY.**

- ❖ Supply chain visibility at tactical level through a tactical control tower to design lanes.
- ❖ Supply chain visibility at operational level for the PSCs.
- ❖ Multiple leadtimes set-up in SAP APO DRP system versus one leadtime today.

# Current best industry practice

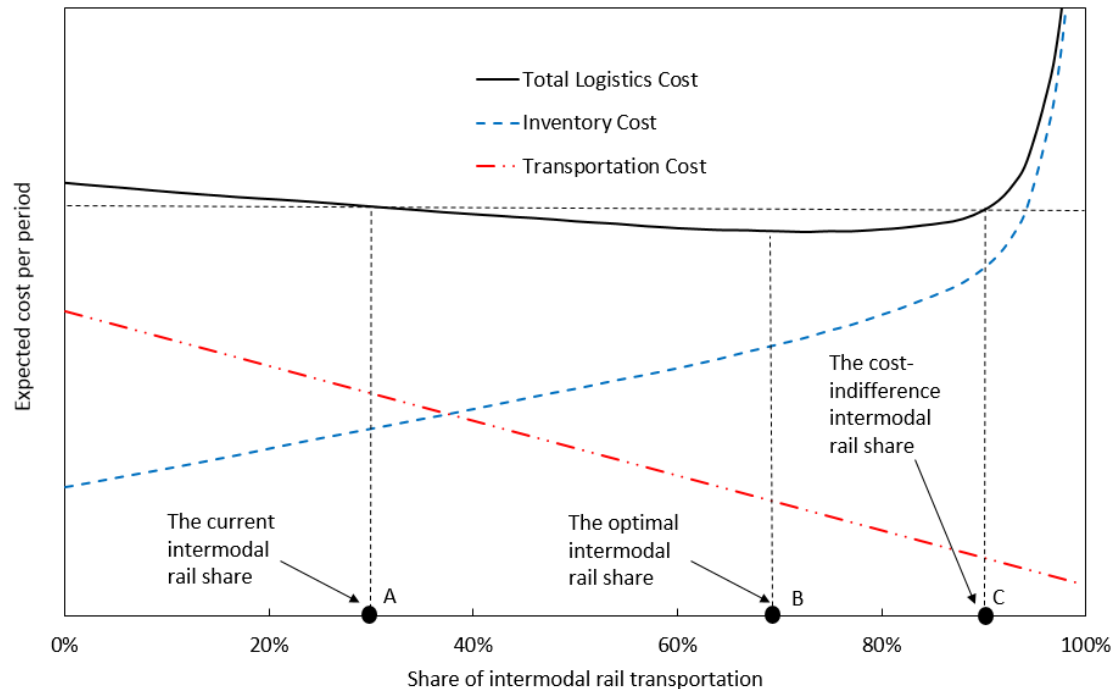


- ❑ Ship the stable demand via reliable slow mode
- ❑ About 20-30% of freight volume

\*Dong, C., Boute, R., McKinnon, A., and Verelst, M., 2017. Investigating synchromodality from a supply chain perspective. Unpublished working paper.

+ Gijbrecchts, J., Boute, R., 2017. Synchronization of intermodal freight shipments in the sharing economy. Unpublished working paper.

# With synchromodality a breakthrough modal shift

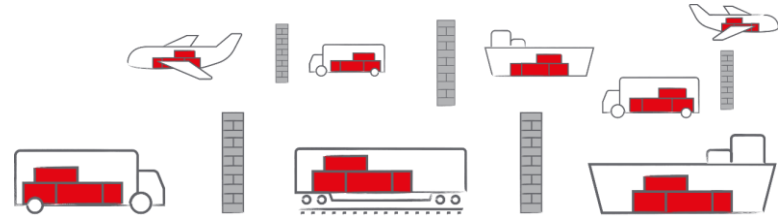
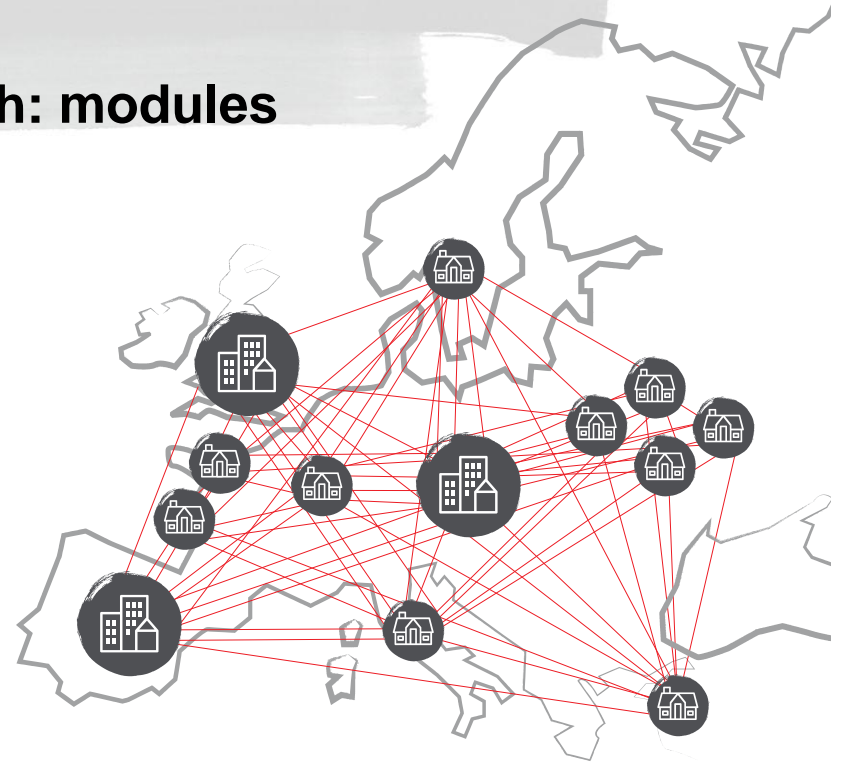
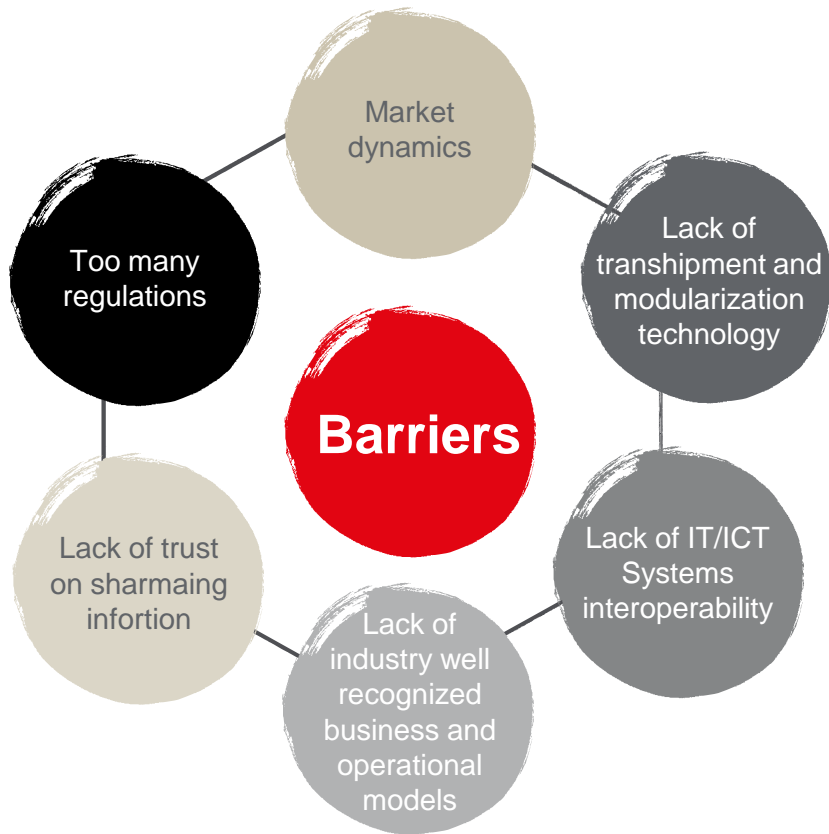


Total logistics costs (*transportation and inventory*) optimization allows to increase slow mode shift from 20-30% to 60-70%



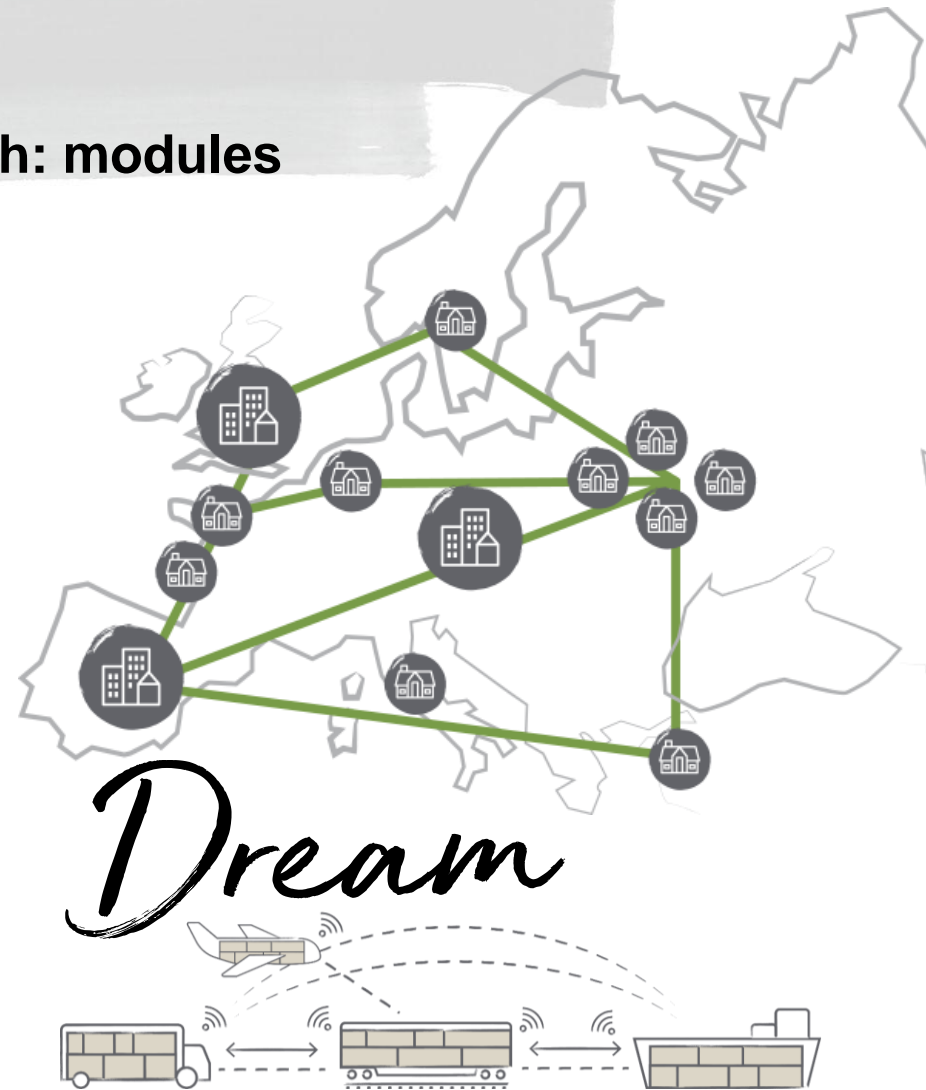
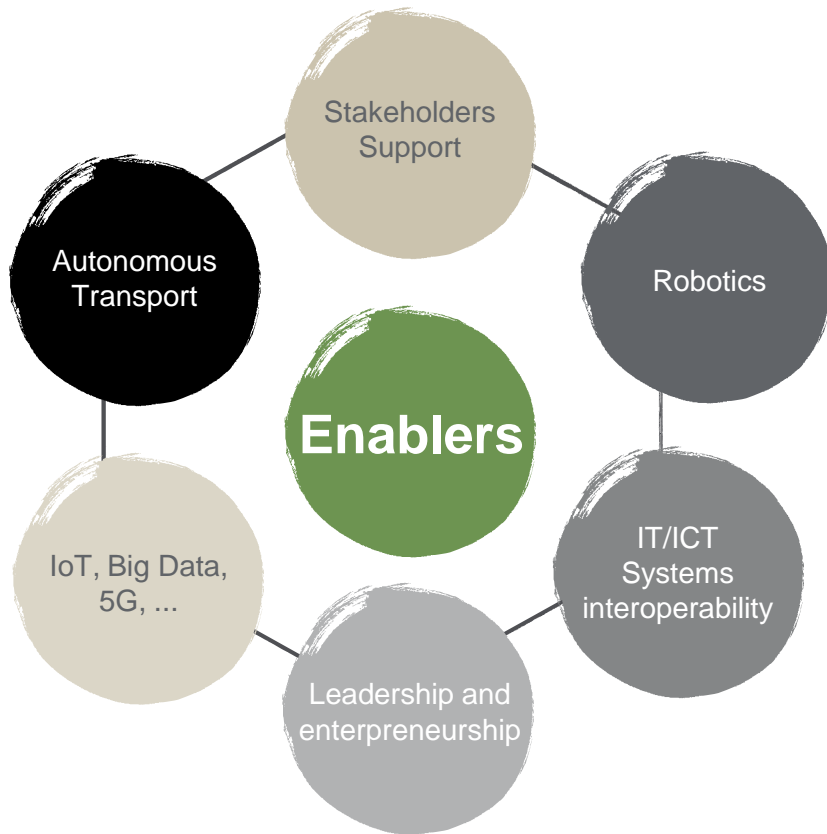
# The key to an open network approach: modules

A generalization of containerization



# The key to an open network approach: modules

A generalization of containerization



*Use your capacity,  
share your assets*



*Through the “Alibaba economy,” we hope to enable consumers and businesses to buy globally, sell globally, pay globally, deliver globally and travel globally.*

*Jack Ma...letter to shareholders 2017*



Thank you

# Contact



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