Part II- goods flows in the world

1- Global Production Networks

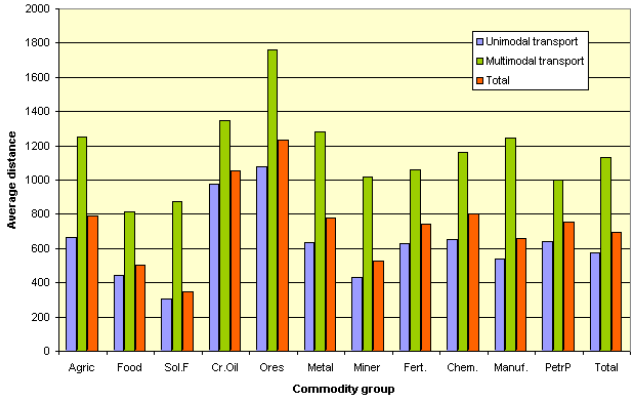
2- trends

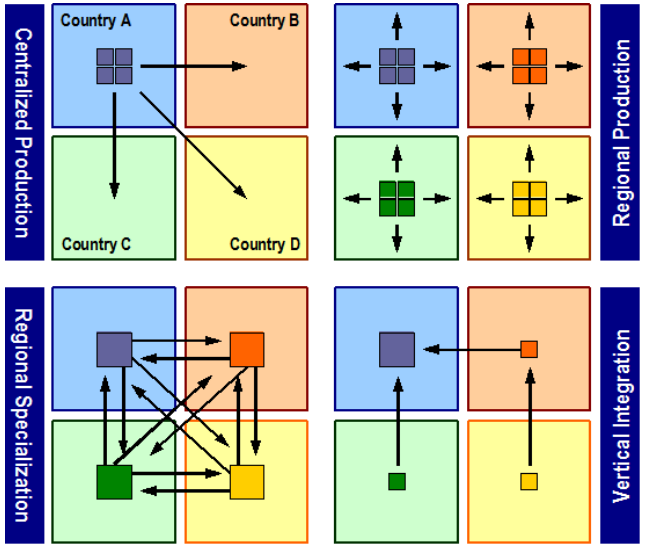
3- flow studies

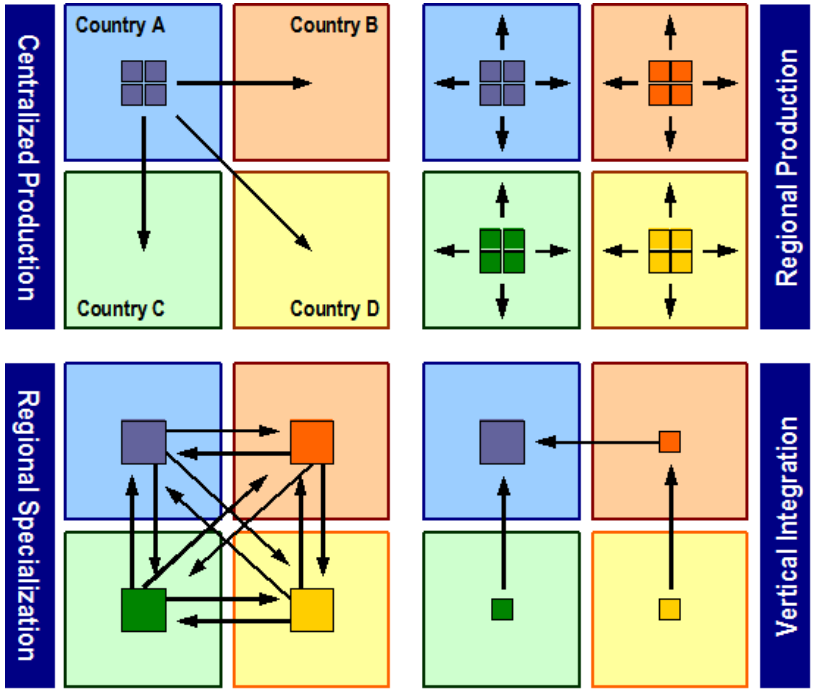
4- multimodal and intermodal transport, possible answer to congestions

1- Global Production networks

- Concept : a cross border arbitration
- GPN and Supply Chain Management
  - Fragmented now and shifted toward periphery
  - Global and regional
    - close interrelationship
  - Horizontally integrated
    - Vertically disintegrated
    - Small and large companies
    - **Goal :** a large number of products through a few processes
    - Maximum revenue through economies of scale

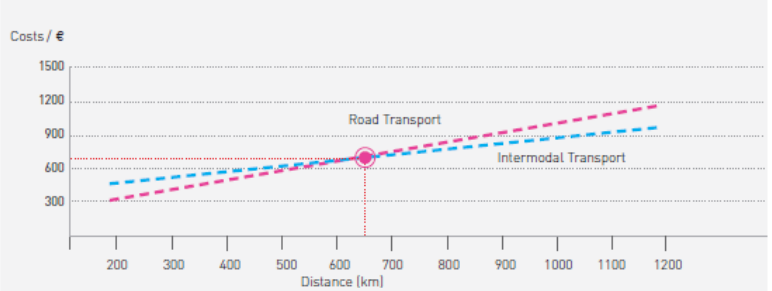






1- Global Production networks

- GPN and global Production /Distribution
  - Major transport modes have made new manufacturing locations
    - Combining labor cost, services, other ressources
  - Transnational corporations
    - More then 40% of US imports from overseas subsidiaries
  - Free trade agreements
    - EU, NAFTA, APEC …
  - Transport deregulation
  - Trade concentration



4- Multimodal and intermodal transport possible answers to congestions

- Continental approach
  - Multimodal and inter continental leading
- Underutilization
  - In continental distances
- Transport cost by mode
  - More than 50 billions @ in EU in congestion

4- multimodal and intermodal transport possible answers to congestions

Shippers and consignees

- Supply chain : risk of stock-out, lost business
- Level of safety stock : delayed shipment, longer transit time congestion over charges, higher inventories

Shipping lines

- Longer waiting time for berth
- Bypassing intended ports of call : higher fuel costs, lost business, higher feeder costs, reduced capacity

Container terminal operations

- Additional stack movements : longer cycle times, increasing handling cost, higher labor cost, reduced capacity
- Intermodal operators
  - Disruption to schedule, longer waiting times, missed connections, higher operating costs

Safety gantry for containers

- Evolution

Decade	Cost	Height	Reachable deck
1960	0.75 M $	19 m	Till 35 m
1970	2.4 M $	25 m	Till 39 m
1980	6 M $	30 m	Till 47 m
2000 …	8 M $	40 m	53 m and more

4- multimodal and intermodal transport possible answers to congestions

Traditional players and new ones

Horizontal and vertical integration

Rail integrating forward

Better loyalty

(ERS carrier haulage, Merchant Haulage market)

Seaport terminal market (Hutchinson, P.SA.A, P&O, Eurogate…) vs specialization = railway operator, shortsea operator (ECT, DeCeTe)

Explosion in BRIC trade : Brazil, India, Russia … ? China

Asian ports more than 55% of container traffic and 50% export

Port ranking examples

Asia : Shanghai, Singapore, Hong-Kong

Middle East :Dubai, Salaha, Jeddah

Europe : Rotterdam, Antwerp, Hamburg

Africa : Port Said, Durban, Tangier Med

Part III- Intercontinental distances

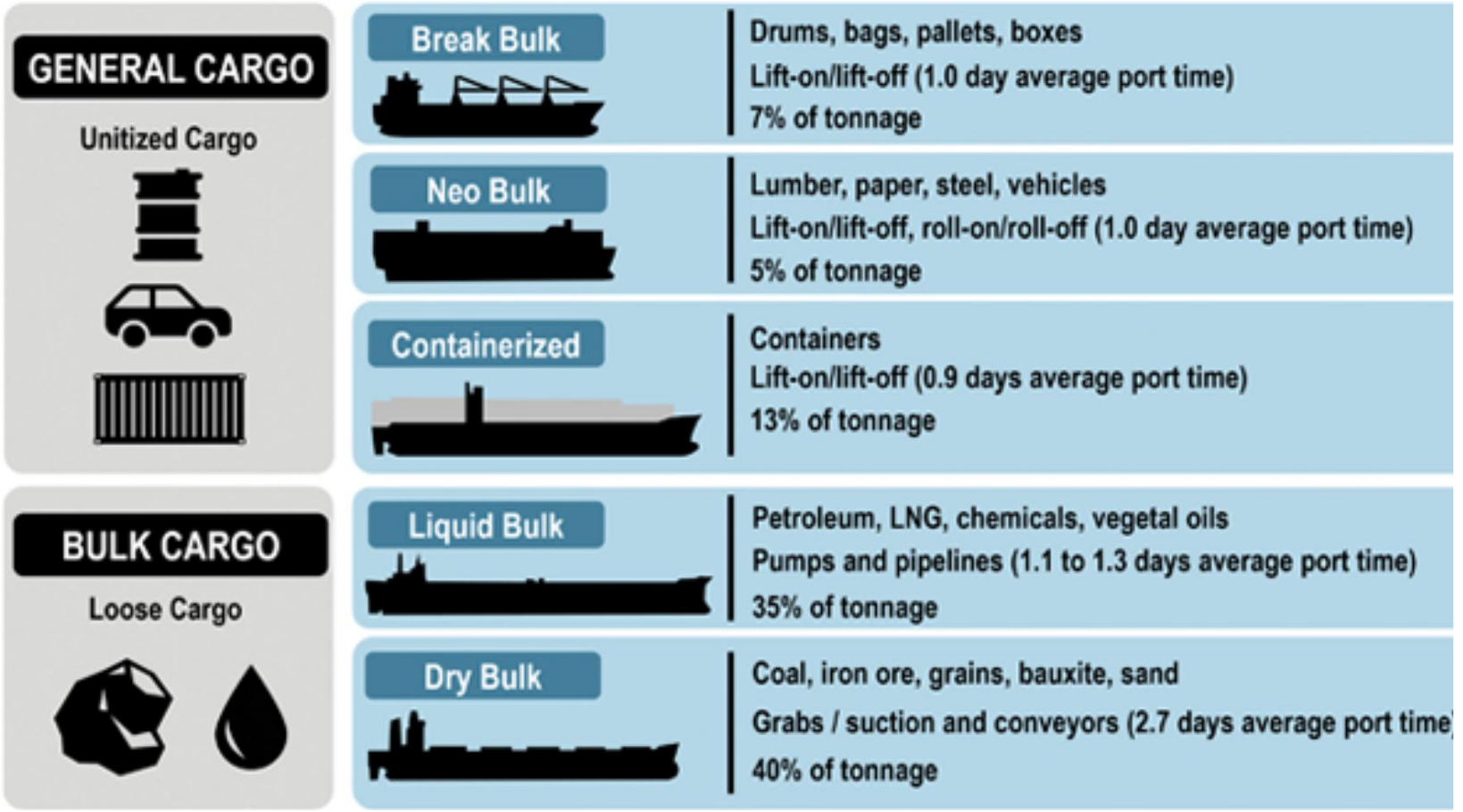
1- International transportation

2- Loading units

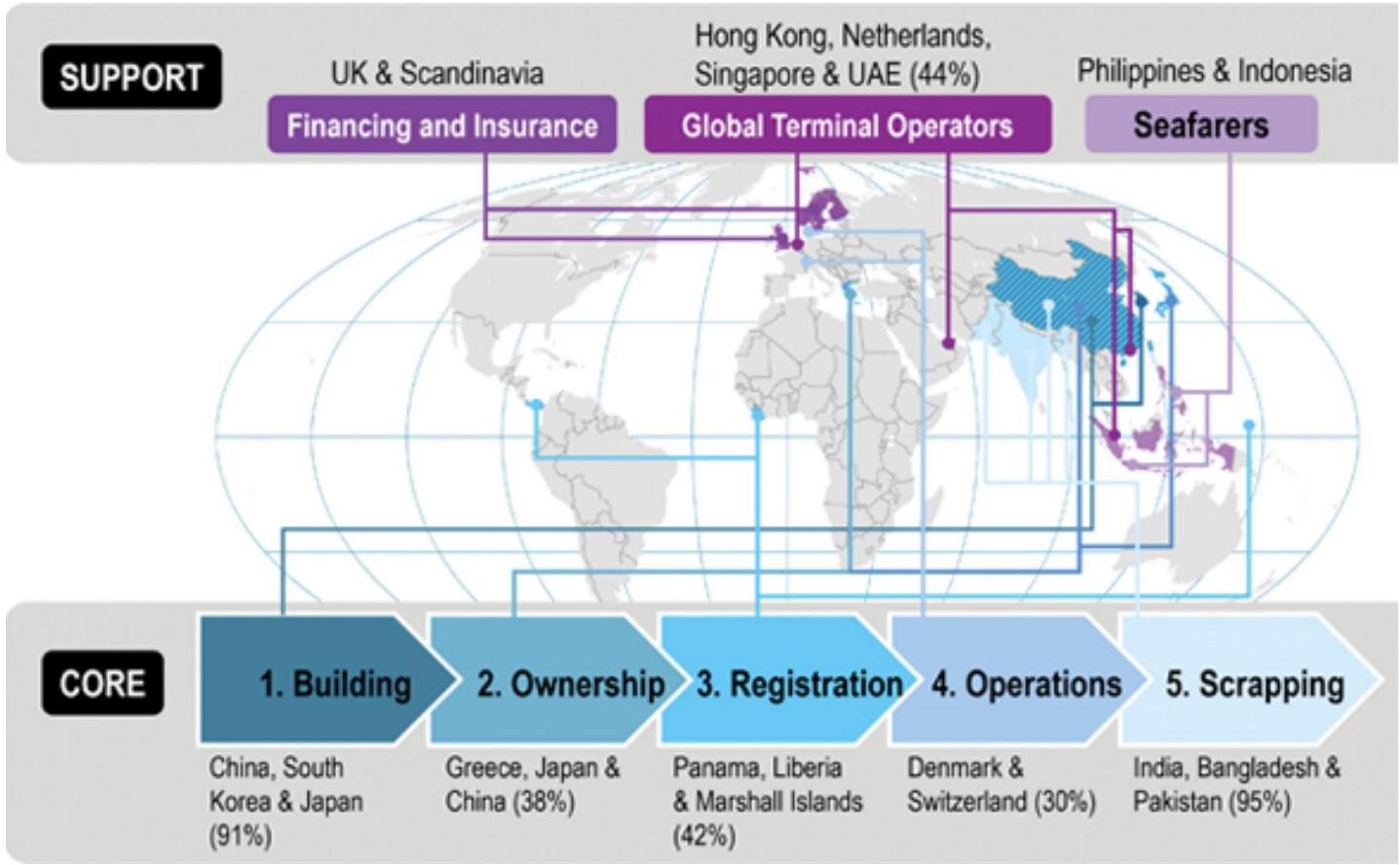
3- Combination of modes

4- Case studies

SEA TRANSPORT



Sea industry



1- International transportation

- Development of ships
  - Ship : vary considerably in size
  - Set routes
  - Sea containers
  - ISO standards
    - ISO 668:1995 classification, dimension and rating
    - ISO 6346:1995 Coding, identification and marking
    - ISO 1161:1984 Corner fittings-specification
  - Short sea shipping – semi trailers
- Development of relevant infrastructures

Set routes

- Planning and designing Transportation Route Transport geography
  - It refers to the possibility to transport the goods on such route from origin to destination via available transit points.
  - Selection of the modes of Transport and routes.
  - Hub or Connecting Point Along the designed corridors, where is the best hub to be used. Some time, it is not necessary to use Major Hub.
  - Availability of Common Carrier in designated planning of transport routes
    - Common Carrier is very import factor to consider when planning and designing for Transportation Route whether they are available in such planned routes.
    - Such carriers are able to carry the goods according to the nature of the goods.
    - Measures of Carrier rules that may not allow to do something with their equipment. For example DHL use SOC from EU to Japan

  Current Situation along the corridor

  MTO shall identify what is the current situation from origin to hub or connecting point and from connecting point to next connecting point and final destination.

Set routes

- Planning and designing Transportation Route Transport geography
  - Example
    - Pain Point in wrongly selection of Hub – real life
      - Normally, shipment ex Bangkok to Rotterdam transit time is 24 days.
      - Back log of sea freight was two weeks, shipper has no choice but to call MTO to find solution that shipment should arrive within one month
      - MTO decided to use Bangkok – Dubai by sea and connect from Dubai to Rotterdam by Air as the best route.

    Pain Point in wrongly selection of Hub – real life

      - After shipped out MTO found out that Dubai port was congested and containers were remained in port for two weeks whist the transit time from Bangkok to Dubai took already two weeks.
      - Getting the goods out of the port, MTO in Dubai faced to back log of the airfreight another one week.
      - Total Transit time is 5 weeks and two days.

Set routes

- Planning and designing Transportation Route Transport geography
  - Alternative Transport Corridors and Customer Needs The best plan is to match with the customer needs and requirement
  - there should be flexible to have alternative corridors in the plan.
  - It is not necessary that major hub or gateway shall be used at all time.
  - CASE STUDY : Shipment ex Laem Chabang, Thailand to Kaiserslautern, Germany
    - Laem Chabang – Rotterdam – Mannheim – Kaiserslautern
    - Laem Chabang – Hamburg – Mannheim – Kaiserslautern
    - Laem Chabang – Hamburg – Mainz – Kaiserslautern

  Infrastructure and Equipment at transit or connecting point

  The availability of Free Zone, ICD including standard or special equipment is important based on nature of the goods, handling method, and customs formality at transit point.

Set routes

- Planning and designing Transportation Route Transport geography
  - Operation of Transit / Transshipment at Transit point The customs process of transit point is very important factor.
    - It could create delay with full range of formality in some countries or even transit could not be made
    - for example in Cambodia, there is no regulation for transit for the time being.
  - Operation of Transit / Transshipment at Transit point In Singapore
    - Only registered as Forwarder, cargo agents can submit Transshipment permit application if the shipment is covered by Through B/L or Airwaybill in order to perform transit procedure.
  - In Thailand
    - If MTO are not licensed Transit Operator (must place Bank Guarantee with Customs) , such MTO must place Bank Guarantee to cover the Customs Debt before processing transit formality.

Set routes

- Planning and designing Transportation Route Transport geography
  - Operation of Combination Transport system in ASEAN – CASE STUDY

a) Shipper at First Philippine Industrial Park wishes to send his goods to Dagon 2 in Yangon, Myanmar. He can use SEA/SEA mode transshipped at Singapore if he controls transportation but the shipment is FCA term.

b) Consignee prefers to use Multimodal Transport via Singapore, Malaysia and Thailand to Myanmar due to some reasons such as customs procedure, transit time .

c) Possible mode of transport is: Feeder vessel from Manila South Port to Singapore Truck from Singapore to Yangon

d) Players involve: Myanmar MTO, Philippines MTO and Singapore MTO In Transit Truck Operator

MTO Philippines use Feeder vessel to Singapore and request his agent,

MTO Singapore to handle trucking to Yangon.

MTO Singapore has no truck license of in transit transport under AFAFGIT and AFAFIST , then he has to hire Licensed Truck Operator.

MTO Philippines acts as Carrier for MT operation MTO Singapore acts as subcontractor of MTO Philippines

Set routes

- Planning and designing Transportation Route Transport geography
  - Operation of Combination Transport system in ASEAN – CASE STUDY

    MTO Singapore enters into ACTS as Principal and responsible for customs debts along the transport corridor from Singapore-MalaysiaThailand-Myanmar where his guarantors shall be located there.

    Transit Transport Operator (Licensed Truck) is responsible to carry the goods along the corridors according to their Standard Trading Conditions or applicable international laws or local laws.

    MTO Philippines issue MT Document to Shipper and Shipper send such MT Document to Consignee.

    MTO Myanmar acts as MTO Philippines ‘s Agent – Delivery Agent

    Who is Who in this scenario:

    MTO Philippines = Principal or Carrier on MT Document MTO Singapore = Agent of MTO Philippines and Principal in ACTS MTO Myanmar = Destination Agent of MTO Philippines LICENSE TRUCK OPERATOR = COMMON CARRIER MTO Myanmar deals with Consignee for the carriage but Shipper in Philippines is the party who concludes the contract of carriage with MTO Philippines.

    Note:

    1. If MTO Singapore wishes not to become Principal in ACTS, he may ask Licensed Truck Operator to act as Principal in ACTS , in case both parties agree so.
    2. Cross border transport Operators can be divided in two types: a) Licensed Truck Operator – owner of trucks b) Principal which can be Licensed Truck Operator or MTO, forwarder or exporter, who enters into ACTS declaration.

Set routes

- Planning and designing Transportation Route Transport geography
  - •Selection of Agents and Competitive Cost
    - • Select Strongest Agents in the planned Corridors. It is recommended to have Agents within the same group of network rather cross networking for a better communication during the journey of carriage.

      ASEAN MTO might have a weak point on networking when compare with Multinational Company likes Big 4 as their offering to client might be lower by using Cost Center scheme than Profit Center scheme.
  - Risk assessment

    Political today,

    Port Congestion,

    Strike, Riot,

    Back log of common carrier,

    unforeseen cost from special handling
  - Total Cost Computing

    Stuffing / Unstuffing charge and Loading / Unloading Trucking charge/ Terminal Handling Charge

    Customs Clearance Charge

    Transportation of each leg Duty & Tax (awareness of H.S.Code and declaration) Other Transport Surcharges; BAF, CAF, FAF, YAS, AMS, ENS,AFR, WAR risk, demurrage/detention etc.

    Document fee

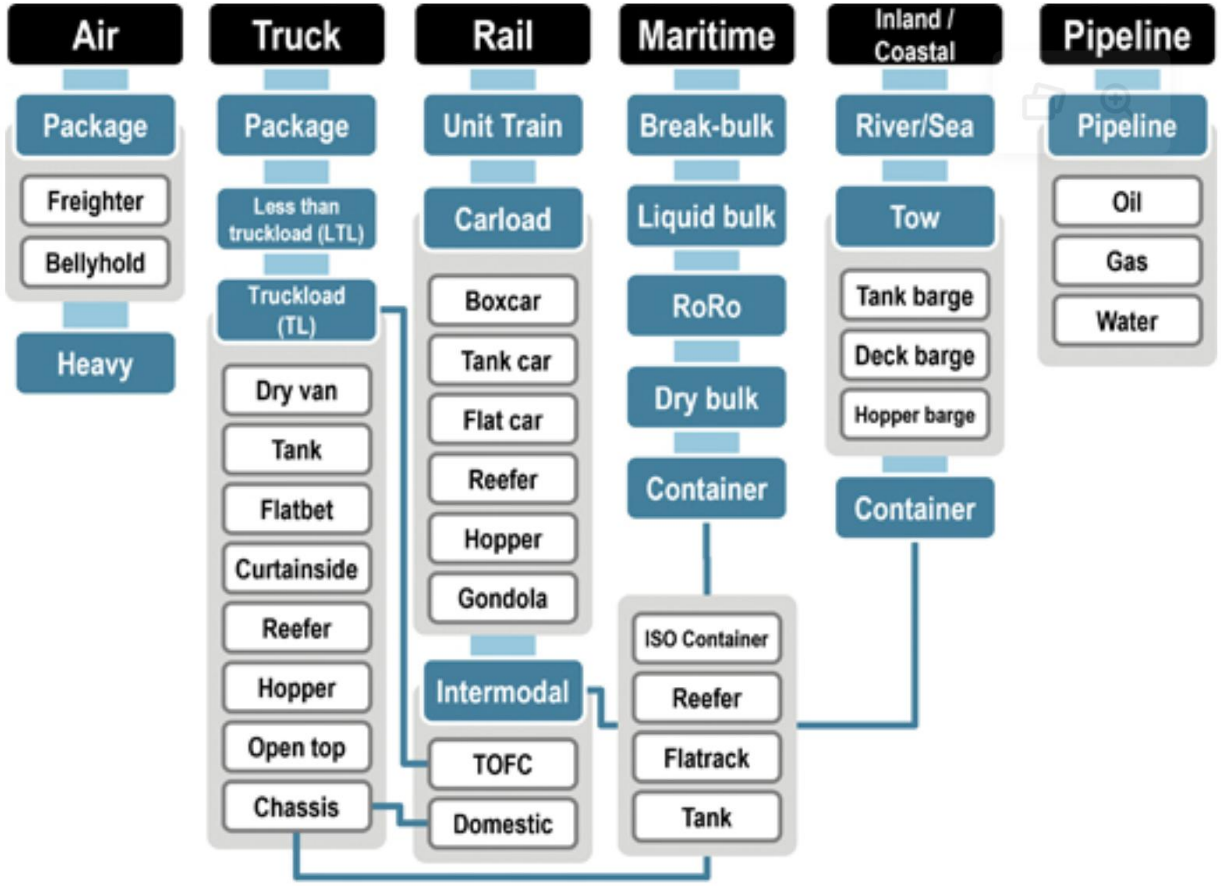
    Agent handling charge

    Special equipment hire

Equivalent to

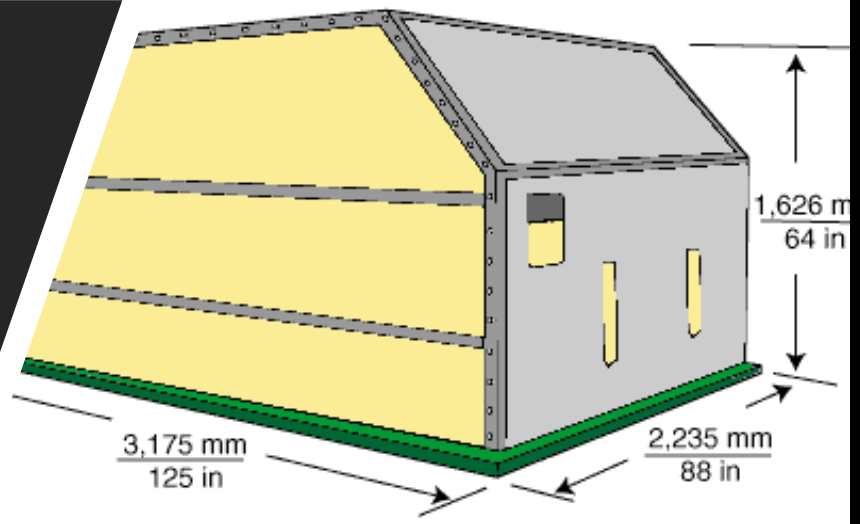
- 1 mm = 0,03937 inch
- 1 cm = 0,3937 inch
- 1 m = 1,094 yards
- 1 km = 0,6214 mile
- 1 cm3 = 0,061 cubic inch
- 1 kg = 2,2046 pounds
- 1 m ton = 0,9842 ton

Loading Units

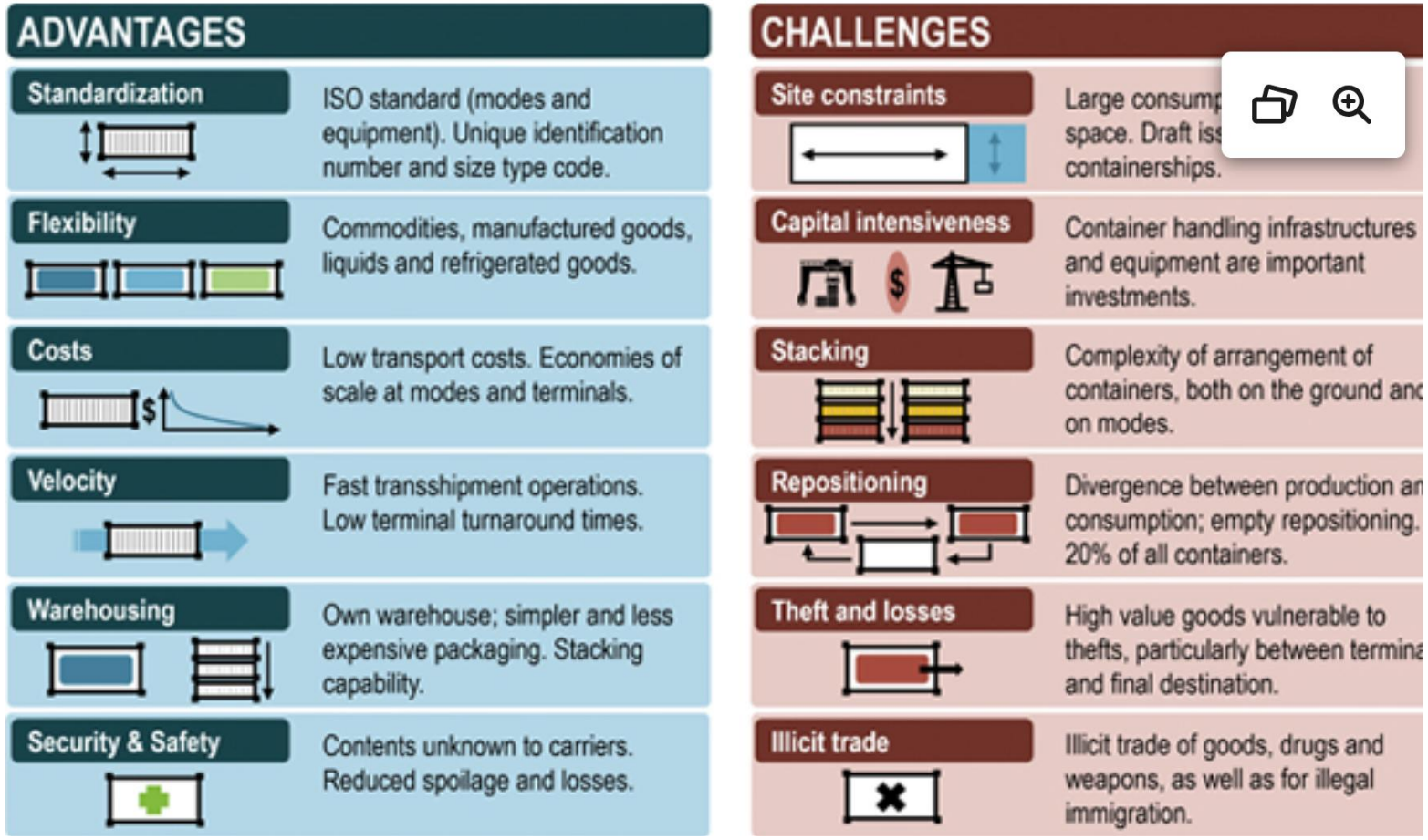


2- loading units

- Containers
- Air container
- Maritime container
  - Investments
  - 20’ 40’ containers
- Container service
  - Transit time – handling – reducing number of individual pieces of cargo
  - Substantial savings in packaging
  - No need for covered warehouse



containers


ADVANTAGES
Standardization
ISO standard (modes and equipment). Unique identification number and size type code.
Flexibility
Commodities, manufactured goods, liquids and refrigerated goods.
Costs
$
Low transport costs. Economies of scale at modes and terminals.
Velocity
Fast transshipment operations. Low terminal turnaround times.
Warehousing
Own warehouse; simpler and less expensive packaging. Stacking capability.
Security & Safety
Contents unknown to carriers. Reduced spoilage and losses.
CHALLENGES
Site constraints
Large consump
space. Draft iss
containerships.
Capital intensiveness
$
Container handling infrastructures and equipment are important investments.
Stacking
Complexity of arrangement of containers, both on the ground and on modes.
Repositioning
Divergence between production and consumption; empty repositioning. 20% of all containers.
Theft and losses
High value goods vulnerable to thefts, particularly between termina and final destination.
Illicit trade
Illicit trade of goods, drugs and weapons, as well as for illegal immigration.

- Container applications
  - One way shipping
  - Static ground storage
  - Economical way to add warehouse
  - Most common size of containers
    - Standard width
    - Non ISO overlength and over width containers
    - Regional pressures
    - To cohabit at interface points

ISO Containers

Also exist **45’ (2.42 m wide), 53’**

- ISO Norm 668 to **20’ and 40 ‘ dry containers**
- Minimum size

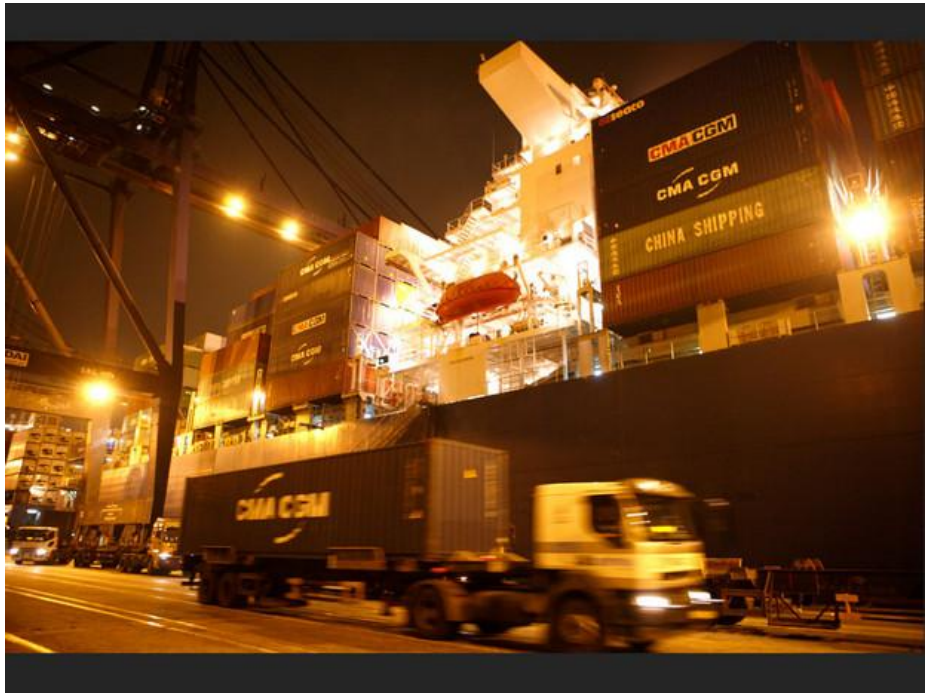
	Length	Width	Height
	mm	mm	mm
20 ‘	5 867	2 330	2 350
40 ‘	11 998	2 330	2 350

- Usual size : 2 350 wide and 2 390 mm high

	Width	Height
	mm	mm
20’	2 286	2 261
40’	2 286	2 261

Usual door opening : 2 340 en largeur et 2 280 mm en hauteur

- Various containers
  - Standard
  - Hard top
  - Open top
  - Flat rack
  - Platform
  - Ventilated container
  - Refrigerated
  - Tank
- Density answer
  - Heavy goods – shorter container
  - Low density – larger containers



2-

- Standard container
  - General cargo – lashing devices

2-

Hard top container

- Removable steel roof
- Heavy loads
- loading

2-

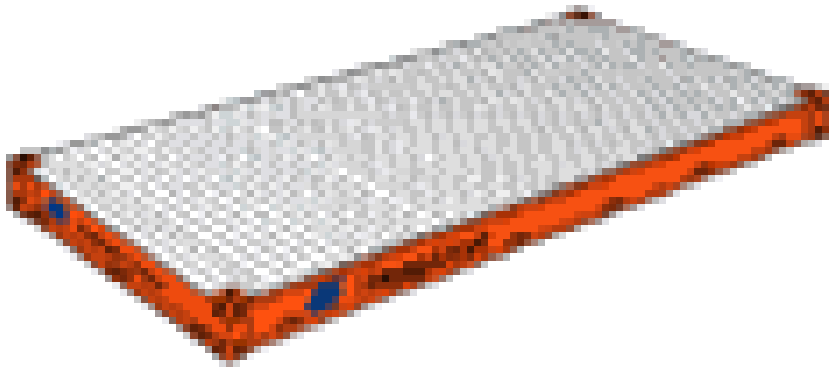
- Open top container
  - Removable tarpaulin, overheight cargo
  - loading

2-

- Flat rack
  - Heavy loads

2-

- Platform
  - Heavy loads – oversized cargo
  - Non domestic shipments



2-

- Ventilated
- Refrigerated container
  - Electrically operated unit

2-

- Tank container
  - Transport of liquid food

Discussion

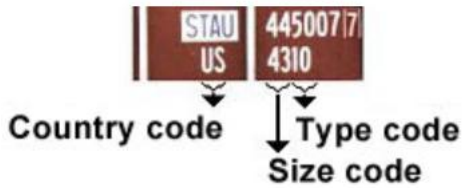
- Container advantages and inconvenience

- Registration of containers
  - Interchange among carriers
  - Identification
  - Rolling stock registration
  - With a rail car

- Container identification
  - Owner MSK for Maersk example
  - U for freight container
  - Registration number (6)
  - Check digit

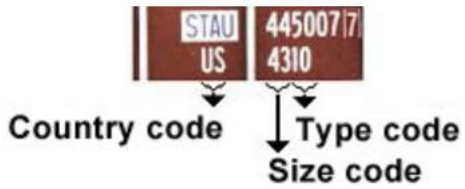
- Container type
  - Length
  - Width
  - Container type

Marking on Containers : Size and Type Code			ISO 6346
1	2	3	4
Length	Height	Type	Features



1st digit	The digits have the following meanings...			
Length	1 = 10 '	2 = 20 '	3 = 30 '	4 = 40'

2nd digit	The digits have the following meanings...			
Height	0 = 8'	1 = 8' g.n.t	2 = 8' 6"	3 = 8' 6" g.n.t.
Height	4 = > 8'6"	5 = > 8' 6" g.n.t.	6 = > 4 ' 3 "	7 => 4' 3 "g.n.t.
Height	8 = > 4' 3 "< 8'	9 = < 4'		



Marking on Containers : Size and Type code			ISO 6346
1	2	3	4
Length	Height	Type	Features

3. Ziffer = Type		4. Ziffer	
0	closed general purpose	0	end opening(s)
		1	end & full side opening(s)
		2	end & part side opening(s)
		3	end & roof opening
		4	end & roof & side openings
1	closed vented	0	smaller passive vents upper part
		1	bigger passive vents at upper part
		3, 4	passive vents at upper & lower part
		6	mechanical ventilation, located inside
		8	mechanical ventilation, located outside
2	thermal insulated heated named cargo	0	insulated
		1	insulated
		2	heated
		5	named cargo: livestock
		6	named cargo: cars
3	thermal refrigerated & heated	0	refrigerated, expendable refrigerant
		1	mechanically refrigerated
		2	refrigerated and heated
4	thermal refrigerated and/or heated removable equipment	0	refrigerated, expendable refrigerant
		1	mechanically refrigerated
		2	refrigerated and heated
5	open top	0	end opening(s)
		1	& removable top member in end frame
		2	& side opening(s)
		3	& removable top member in end frame
6	platform based	0	no endwalls
		1	complete fixed end walls
		2	fixed free-standing posts
		3	complete folding end walls
		4	folding free-standing posts
		5	with frame and roof
		6	with frame and open top
		7	skeletal, with open top and ends

Character	Container length			Character	Container length		
	mm	ft	in		mm	ft	in
1	2,991	10		D	7,450	24	6
2	6,058	20		E	7,820		
3	9,125	30		F	8,100		
4	12,192	40		G	12,500	41	
5	Spare			H	13,106	43	
6	Spare			K	13,600		
7	Spare			L	13,716	45	
8	Spare			M	14,630	48	
9	Spare			N	14,935	49	
A	7,150			P	16,154		
B	7,315	24		R	Spare		
C	7,430						

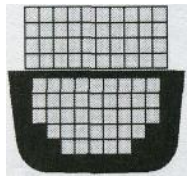
7	tank container	0	non-dangerous liquid, 0,45 bar
		1	non-dangerous liquid, 1.5 bar
		2	non-dangerous liquid, 2.65 bar
		3	dangerous liquid, 1.5 bar
		4	dangerous liquid, 2.65 bar
		5	dangerous liquid, 4.0 bar
		6	dangerous liquid, 6.0 bar
		7	dangerous liquid, 10.5 bar
		8	dangerous liquid, 22.0 bar
8	dry bulk	0-9	no specification
9	air/surface	0-9	no specification


- 3 metre
- opening
- 100 m³
- stackabl
side height
3 sides
go volume
TelliB x
DAF
Picture 31

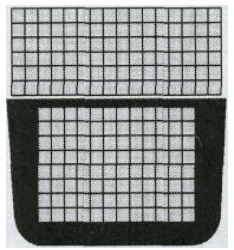
- Sea container ships example
  - Fully cellular containerships
  - Breakbulk vessels
  - Container ship evolution
- Container leasing sector
  - Two major companies
  - Minor companies
  - Middle group
  - 38% of containers
- Ro/ro vessels

2-

1st generation

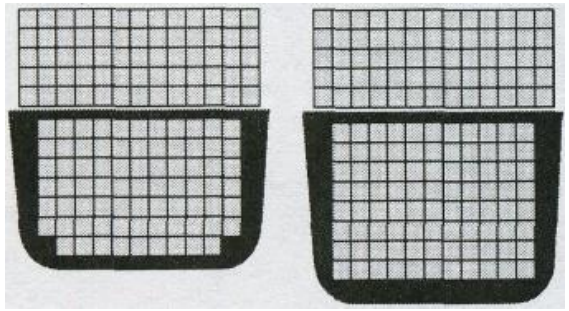


2nd generation



3rd generation

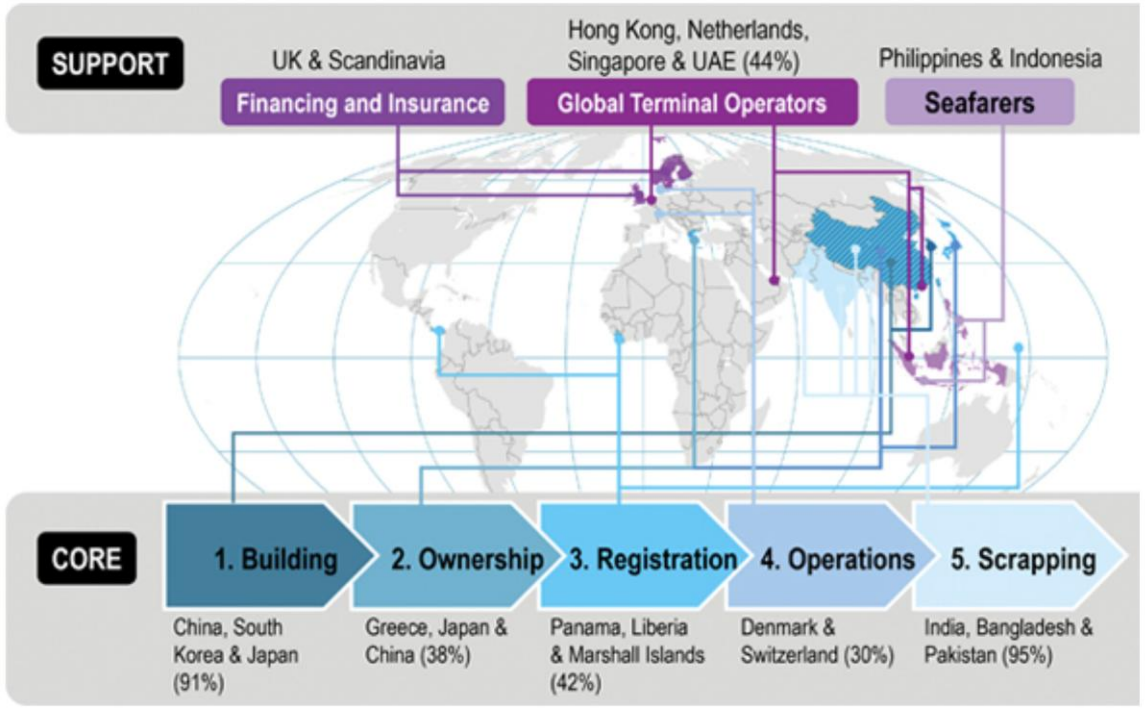
4th generation



5th generation

	TEU	Dead-weight (t)	Speed (kn)	Reefer	Length over all (m)	Breadth over all (m)	Gross Tonnage	Net Tonnage	Power (kW)	Delivery
Berlin Express	7506	100019	25.0	700	320.38	42.88	88493	36175	68640	2003
Hong Kong Express	7506	100016	25.0	700	320.38	42.88	88493	36175	68640	2002
Hamburg Express	7506	100006	25.0	700	320.38	42.88	88493	36175	68640	2001
Shanghai Express	7506	100003	25.0	700	320.38	42.88	88493	36175	68640	2002

SHIPS


SUPPORT
UK & Scandinavia
Financing and Insurance
Hong Kong, Netherlands, Singapore & UAE (44%)
Global Terminal Operators
Philippines & Indonesia
Seafarers
CORE
1. Building
China, South Korea & Japan (91%)
2. Ownership
Greece, Japan & China (38%)
3. Registration
Panama, Liberia & Marshall Islands (42%)
4. Operations
Denmark & Switzerland (30%)
5. Scrapping
India, Bangladesh & Pakistan (95%)

MT COURSE Frédéric Gauthier

Containership choice

- Annualized slot capacity
  - Eastern/Western routes 75% world capacity
  - Transpacific 35%
  - Europe Far East 20%
  - Mediterranean / Far East 10%
  - Transatlantic 10%
  - Mediterranean / US : growing
- Secondary Routes
  - 25% North / South
  - East coast / South America 8%
  - Australasia 14%
  - West coast / South America 4%
  - South Africa 3%
  - West Africa 3%

Containership choice

- Factors of container service shipping lines
  - Type of capacity vs slot charter
  - Type of arrangement : independent, pooling…
  - Size of ship
  - Type of ship : cellular …or not
  - Number of ships : round trip and service level
  - Service frequency : daily …
  - Service speed
  - Service reliability
- Ports of calls
  - Depend on trade routes
    - Asian Europe 15
    - Transpacific 7

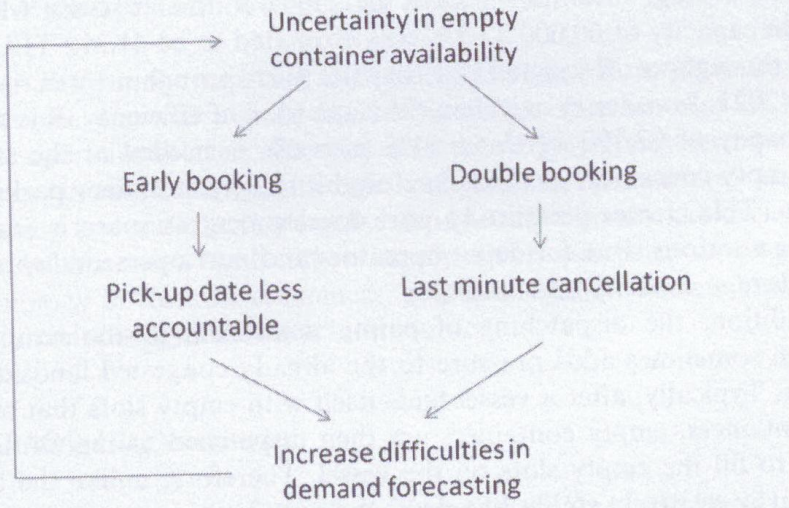


Figure 3.2: Container booking adverse cycle

MT COURSE Frédéric Gauthier

Container flows

Relocation of empty containers

Cost over 20 billions $ a year

Including

Inventory

Piggy back

Utilization of vessel space

Double booking and concellation

MT COURSE Frédéric Gauthier

Discussion

Containership evolution after COVID 19 ?

3- combination of modes

- Airway
  - Air freight traffic
  - Intermodal air-surface containers
  - Improving aircraft turnaround
- Air / road
  - Road transport connected with long distances
  - Intermodal movements by air
    - The nature of air cargo
    - Growth in air freight cargo
    - Planned intermodality helps airfreight economics

AIR PLAYERS

Combination airlines (e.g. Korean Air)

- fleets with freighters and passenger aircraft able to carry freight
- Most of the freighter operations involve long-haul services.

Dedicated cargo operators (e.g. Cargolux) maintain a fleet of cargo-only aircraft

- regularly scheduled services between the airports they service.
- offer charter operations to cater to specific needs.

Air freight integrators (e.g. FedEx Express) operate air and ground freight services

- seamless (at least from the customer's perspective) door-to-door deliveries.

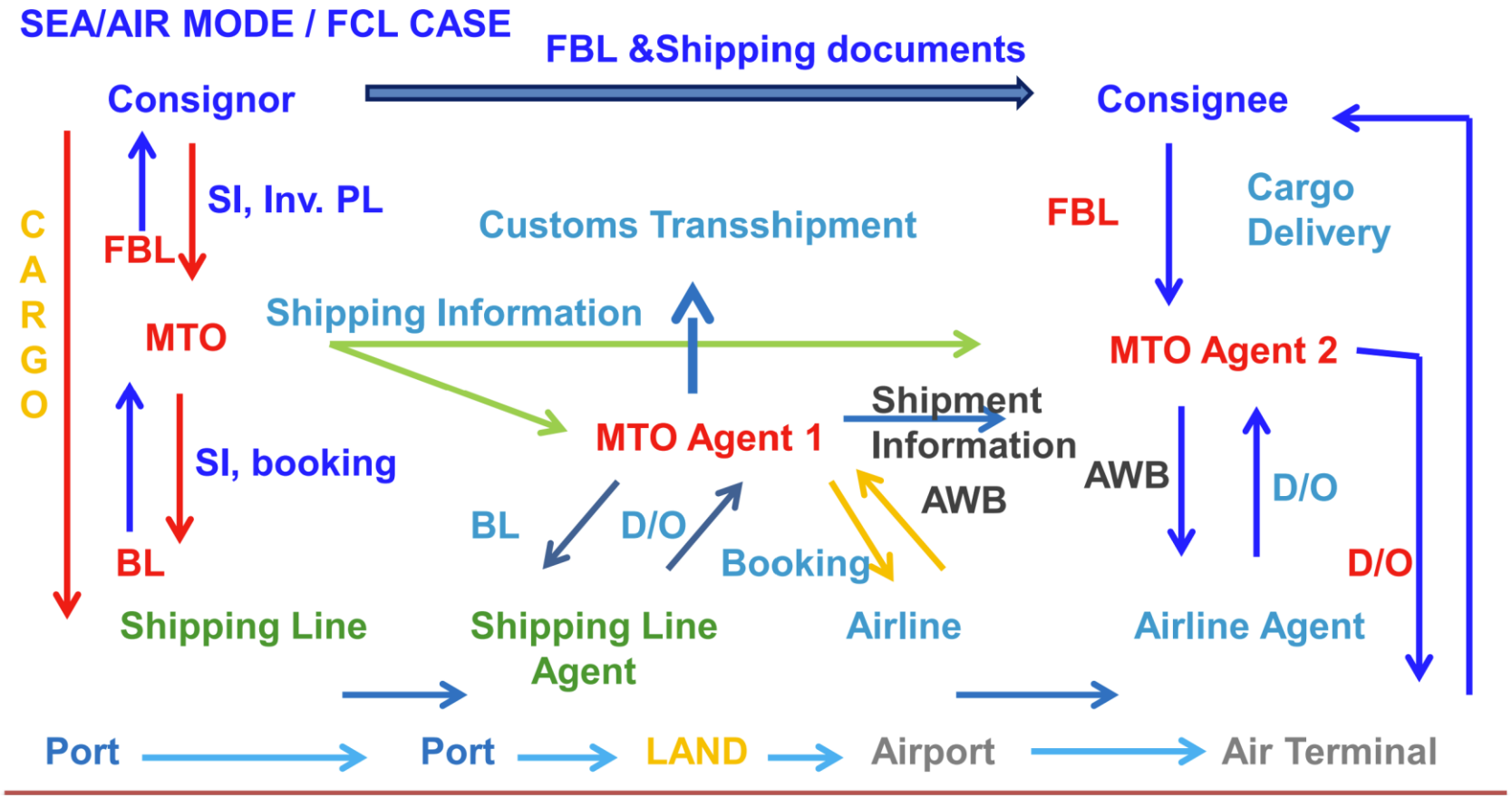
Specialized operators (e.g. Volga-Dnepr Airlines) fulfilling niche services

- cater to specific cargo requirements (e.g. heavy loads) that do not fit the capabilities of standard cargo aircraft.

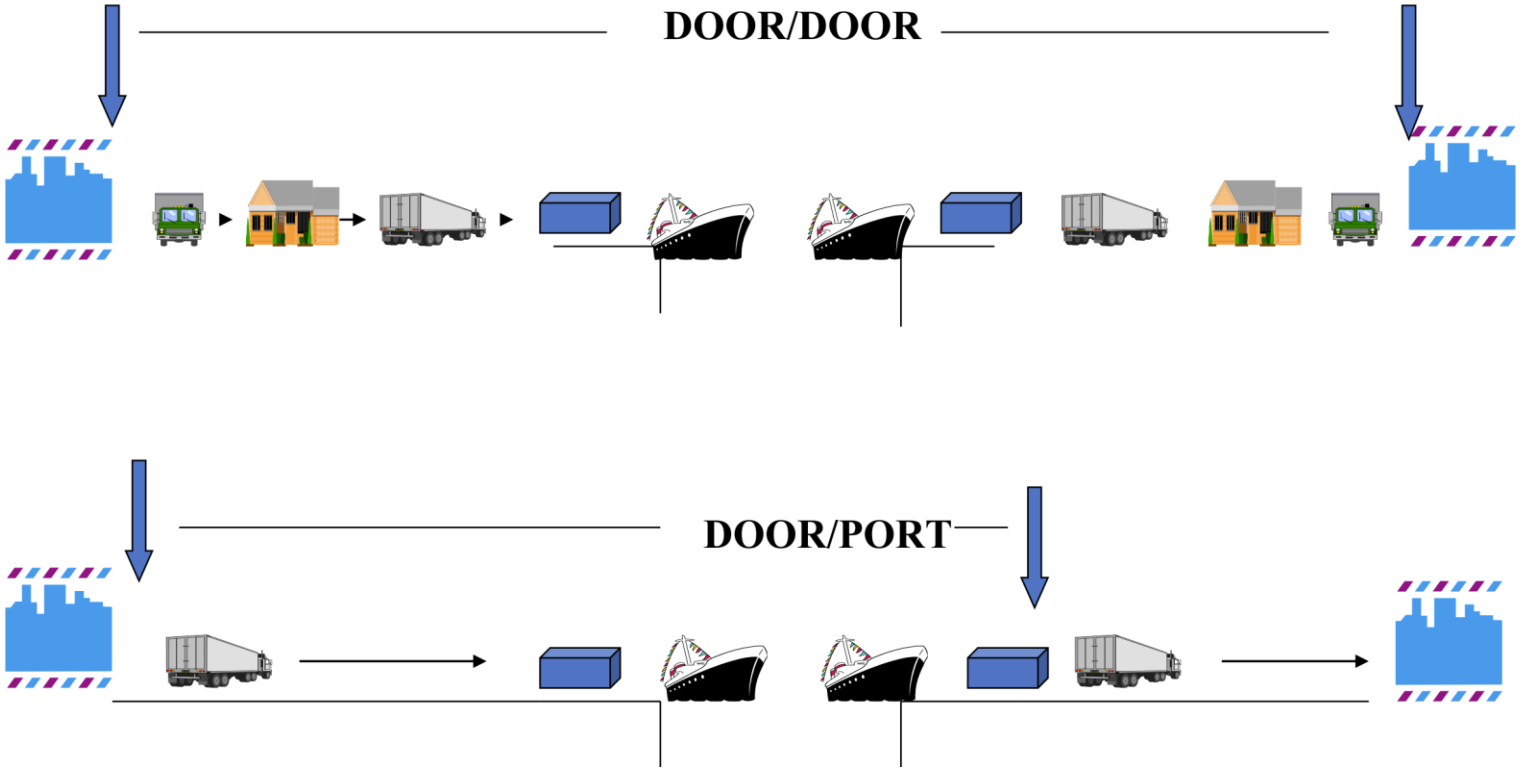
3-

Sea-air intermodal operations	• Availability of aircrafts • To maximize sea use • Large industrialized centers
Sea air to China	
Difficulty in tracking sea air shipments	• Smaller or bigger aircrafts • Air-ground alternative
Convenient corridors	• Far East to Europe • North America / Asia
Intermodal containers	• Weight inconvenience

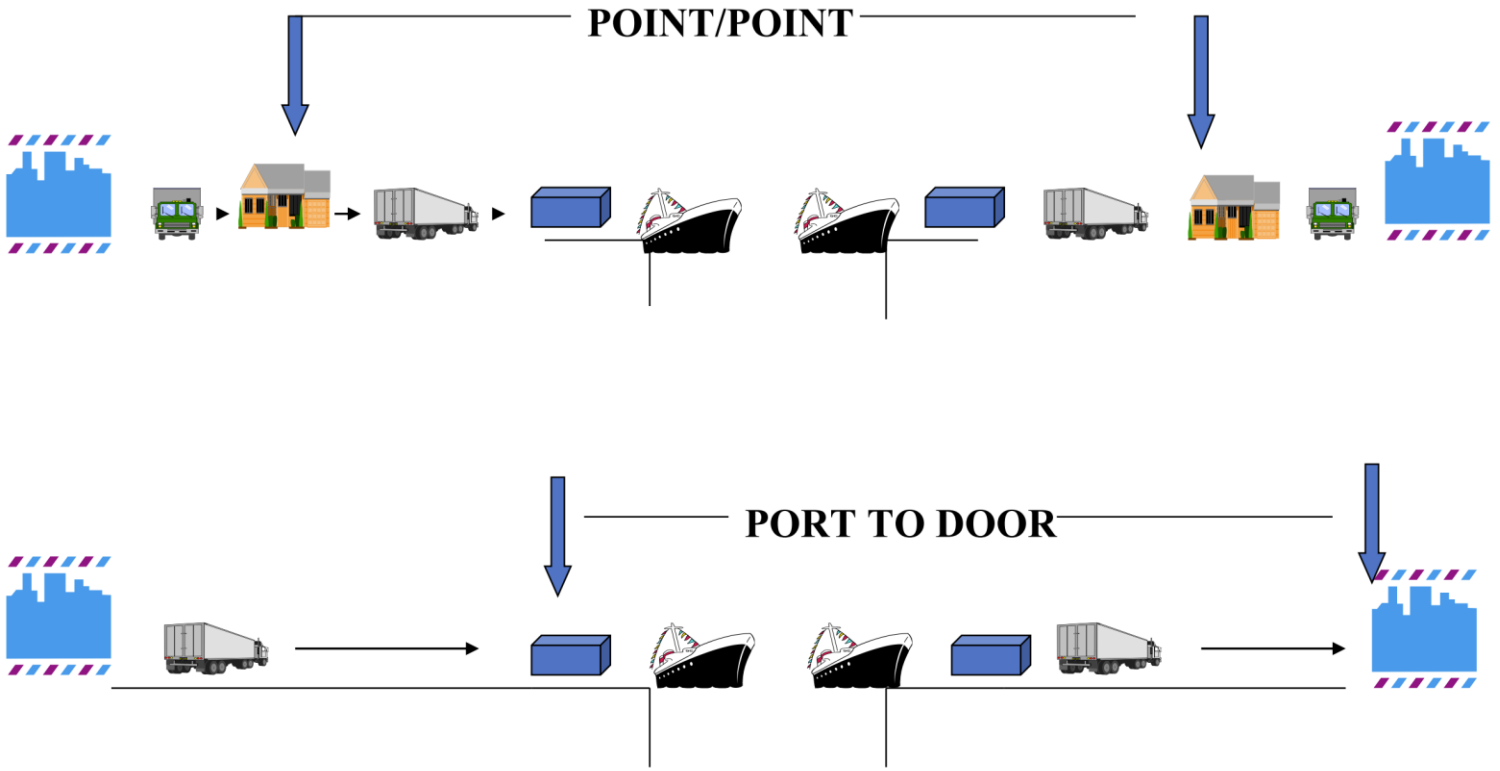
SEA AIR


SEA/AIR MODE / FCL CASE
FBL &Shipping documents
Consignor
Consignee
CARGO
FBL
SI, Inv. PL
Customs Transshipment
FBL
Cargo Delivery
MTO
Shipping Information
MTO Agent 2
MTO Agent 1
Shipment Information
AWB
SI, booking
AWB
D/O
BL
D/O
BL
Booking
D/O
Shipping Line
Shipping Line Agent
Airline
Airline Agent
Port
Port
LAND
Airport
Air Terminal

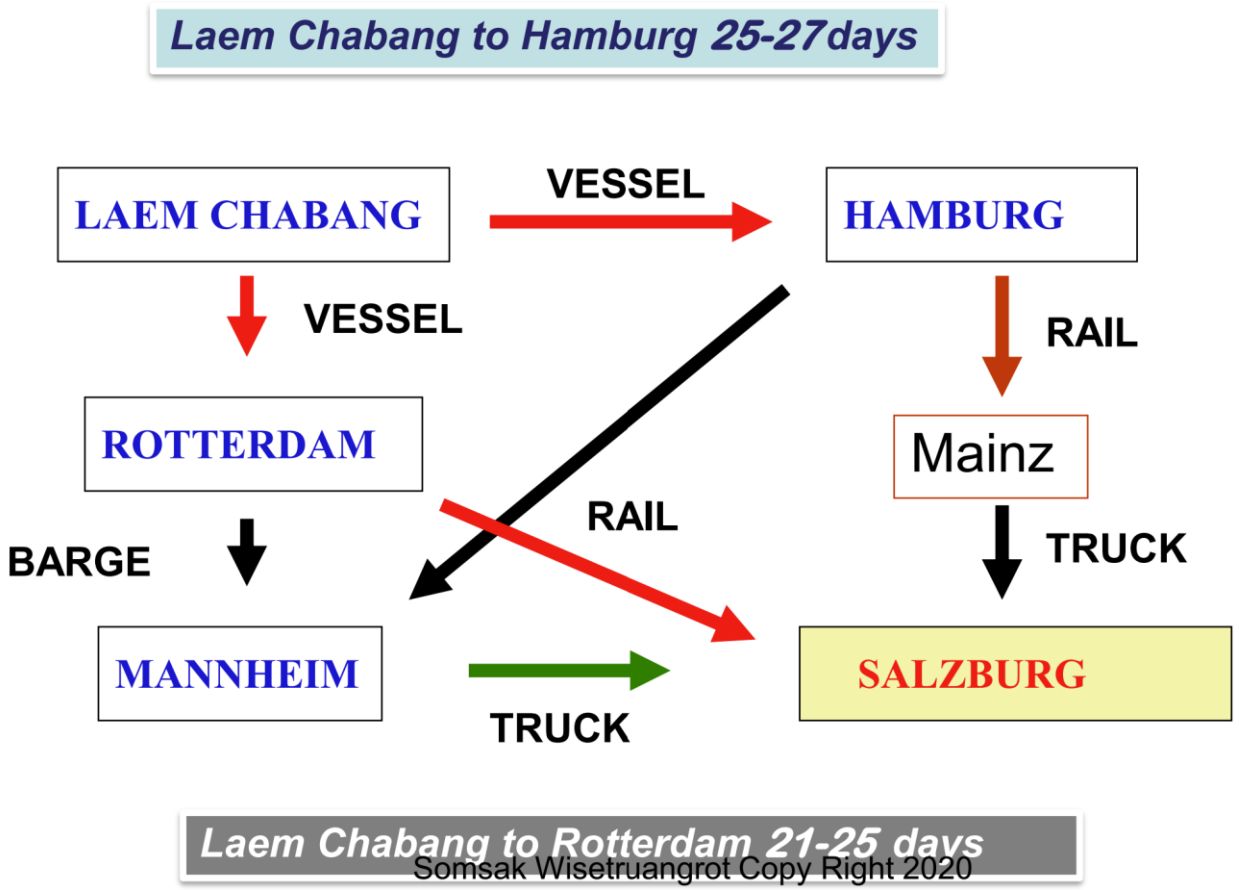
Single corridor



Single corridor



Multiple corridor



Multiple corridors

Hub of Multiple Corridors is referred as the place where the mode of transport is changed to move forward the goods to next destination. Some may refer as “Transshipment Hub” in Forwarder World.

However, in fact Transshipment refers as the Customs procedure under which goods are transferred under Customs control from the importing means of transport to the exporting means of transport within the area of one Customs office which is the office of both importation and exportation.

- *Source Kyoto Convention Specific Annex E*

Example of major hub

Singapore is not only hub for maritime transport but it is multimodal transport hub as well. For example:

- a) The meat from New Zealand is shipped by sea and connect with air transport to EU. This is the collaboration between PSA and SATS
- b) The Garment from Cambodia is shipped by sea and connected by air transport to USA.
- c) Singapore also could serve as hub for South Africa which those shipment may come from ASEAN

Malaysia is a hub for Brunei using both Unimodal Transport and Multimodal Transport as well as the gateway of Halal food to Middle East.

Thailand is a hub for Lao PDR on road-sea mode and few in road-air mode.

- Cambodia on road-air mode Myanmar on road-sea and road-air mode To/from USA, EU, Japan

Example of major hub

- Vietnam is a hub for Lao PDR to access sea transport.
  - Most of shipment is intermodal transport rather than multimodal transport.
- Hong Kong is major hub for China for the shipment to and from any parts of the world.
- Chengdu new Corridor – to/from Europe by Rail
- “silk road”
  - Fiat engines have been loaded into containers at Foggia factory and dray the containers to Nuremberg.
  - These containers are transferred to DHL train that first reached the Polish terminal Mataszewicze, which is directly on the external EU border to Belarus, using western corridor via Kazakhstan up to the west Chinese city of Chengdu and convey to the port in China for sea transport to final destination in Yokohama Japan.
  - Sea Transport takes 60-65 days.
  - Total transit time 35 days.

Example of major hub

- Middle East Dubai in UAE is major hub for Europe for the shipments from South East Asia which are shipped by sea and connect to air transport.
  - Bandar Abbas in IRAN is major hub for CIS countries. (Commonwealth of Independent States – 12 States)
- AFRICA
  - Mombasa in Kenya as gateway for the East African Coast
  - Nairobi as the hub of East and Central Africa
  - Cape town and Durban in South Africa is traditional hub for Africa
  - WEST AFRICA
    - Lome in Togo, Accra in Ghana is the hub for West Africa

Example of major hub

USA

Miami is major hub for South America for the shipment from Europe or Asia under sea-land-sea mode.

The Gateway of this corridor is Los Angles or Long Beach

South America

- Airport Gateway : Sao Paulo in Brazil, El Dorado in Colombia,
- Top 5 sea ports in South America = Santos, Brazil Colon, Panama Balboa Panama Cartagena, Colombia Manzanillo, Mexico

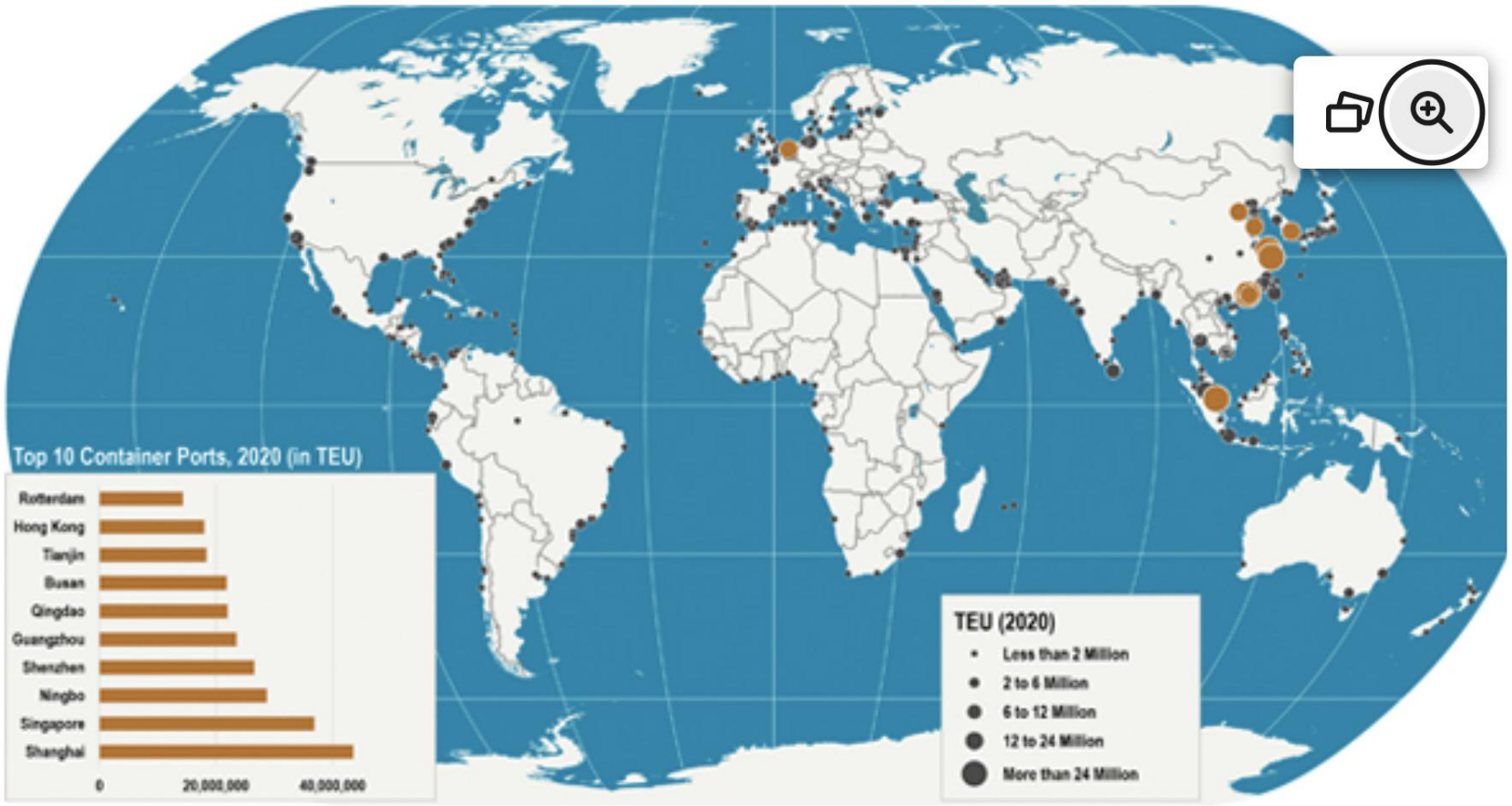
Example of major hub

- Europe

  All major sea ports in Europe is the gateway and hub to connect with road, rail and inland waterways transport to EU

  East Block. Schiphol Airport in Amsterdam and Frankfurt Airport in Germany are the major hub for Multimodal transport in EU

Major hubs examples

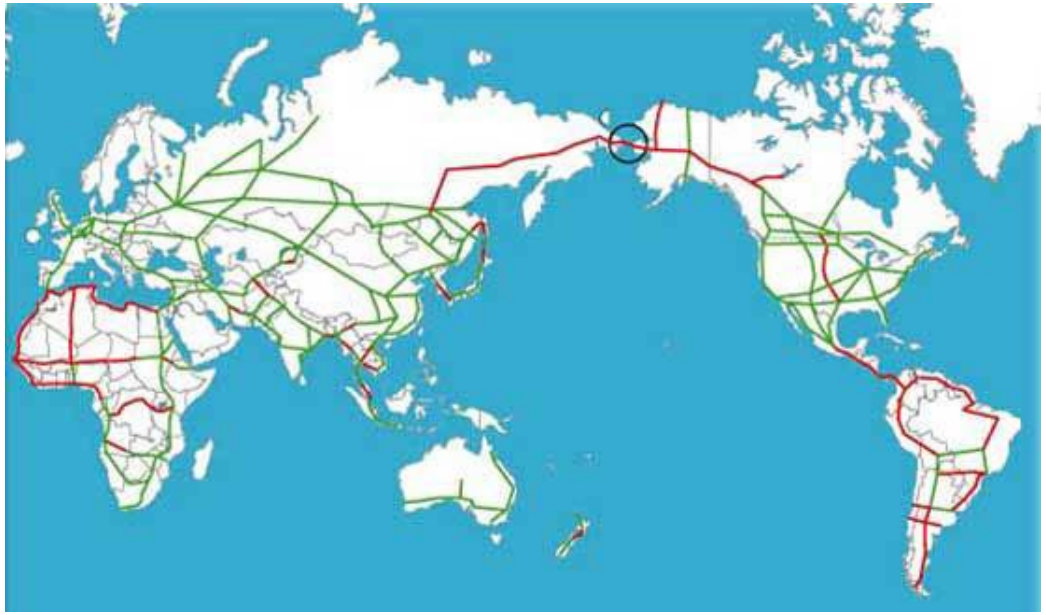


the 25 largest container ports handling more than 49.8% of global traffic in 2020

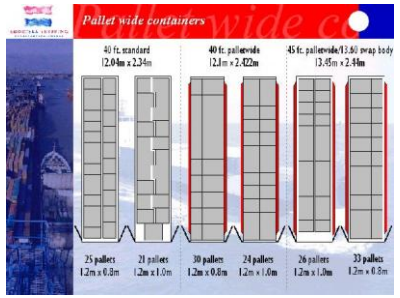
–

- Offer evolution
  - Longer distance, less energy
  - Container size to fit aircraft
  - Lower deck containers
  - Unit load device
- Thus smaller airplanes increasing presence
- Intermodal facilitators
  - NVOCC approach
  - The compulsory international air cargo agents
- Integrated carriers
  - Door to door service compared with airlines’ competitors

- Sea shipping services
  - Deep sea
  - Land bridges
    - Sea land or sea land sea route
    - Flat rate
    - Important international trade routes
  - Land bridge train



- Minibridges : through bill of lading - TBL
- Micro bridges
- Existing port adjacent intermodal facilities
  - Port terminal
    - Road sea and rail sea traffic
    - Ships – railway tracks
  - Transfer of containers
    - Container handling equipment
      - Fittings – handling – be stacked – eight high
      - Oval shaped holes – Inter Box Connectors
      - Oversized forklifts



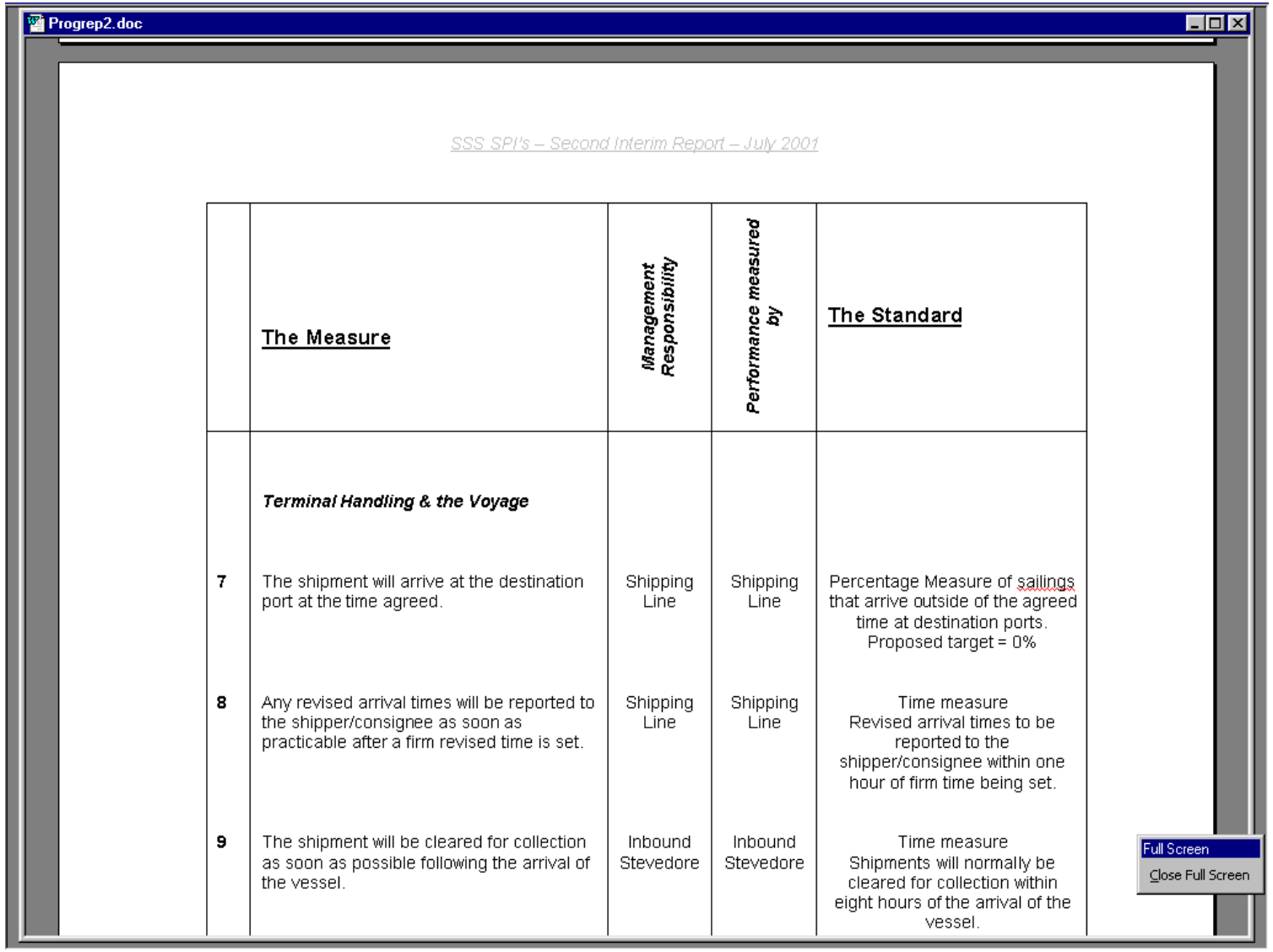
- Sea/rail/road/inland waterways
  - By sea and one or more inland transport
  - Combination containership/LASH ocean vessels
  - A wide range of cargo
  - Rates are lower
  - Connections water / deep-sea
  - Hybrid vessels are in the minority
  - Combination vessels

Dunkirk example

Example

Examples

4-



	The Measure	*Management Responsibility*	*Performance measured by*	The Standard
	Terminal Handling & the Voyage			
7	The shipment will arrive at the destination port at the time agreed.	Shipping Line	Shipping Line	Percentage Measure of sailings that arrive outside of the agreed time at destination ports. Proposed target = 0%
8	Any revised arrival times will be reported to the shipper/consignee as soon as practicable after a firm revised time is set.	Shipping Line	Shipping Line	Time measure Revised arrival times to be reported to the shipper/consignee within one hour of firm time being set.
9	The shipment will be cleared for collection as soon as possible following the arrival of the vessel.	Inbound Stevedore	Inbound Stevedore	Time measure Shipments will normally be cleared for collection within eight hours of the arrival of the vessel.

Sum up

Rank modes combination in easy or not and why ?

Part IV- continental distances

1- continental loading units

2- Continental modes

3- India

4 – European Union

5 – multicontinental issues

6- case studies

Table 2.4 Comparison between the container and semi-trailer shipping segments

Factor	*Container*	*Semi-trailer*
Geographic transport market	Trans-ocean/deep sea/ short sea	Intra-European/short sea
Modal competition	Air for deep sea leg Rail and road for feeder leg	Rail and road + fixed connections
Business priority	Utilising economies of scale	Providing customer convenience
Port geography	Few large hub ports + feeder ports	Many ports – partly bridge substitute
Hinterland depth	Deep	Shallow
Transport time/speed	Fast	Fast
Precision	Day	Hour
Order time	Week	Day/minute
Frequency	Weekly	Daily/hourly
Transport service coordinator	Shipping line, line agent or sea forwarder	Shipper, road haulier or general forwarder
Cargo dwell time in port	Days	Accompanied – minutes or none Unaccompanied – hours
Empty unit dwell time	Days/weeks	Hours/days
Port work content	Substantial	Limited
Rail technology	Very simple – flat wagon/ twist-locks	Complicated – pocket wagon/ king-pin box
Road technology	Awkward at end points	Simple and accessible
Road-rail transhipment technology	Fairly simple – automation possible	Dimensioning factor in weight and handling

Source: Woxenius, J. and Bergqvist, R., *Journal of Transport Geography*. 19(4), 680–688,

1- Continental loading units

Missing interoperability

- Unit load

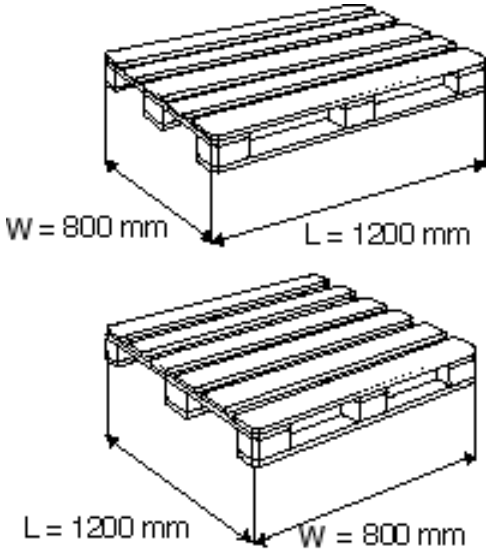
Pallets

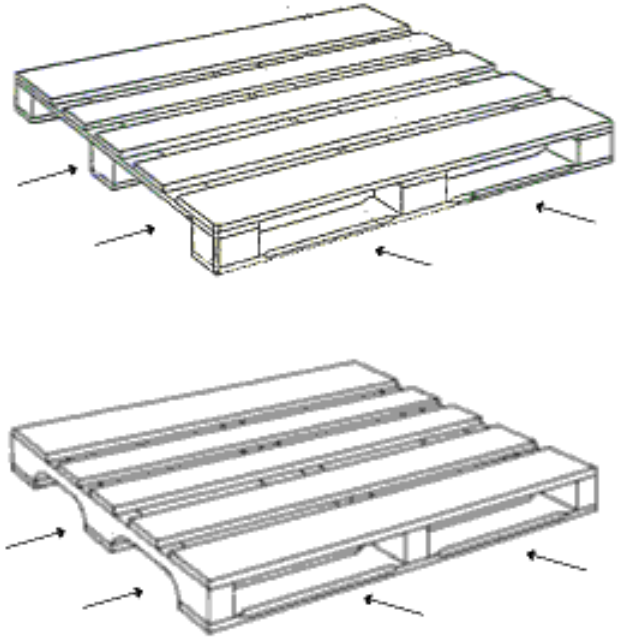
- From start to finish : efficient handling
- Stability
  - Might be shrink wrapped
  - Carton glue and corner boards
- Numerous materials
  - Wood, steel, aluminium, plastic, corrugated fibreboard
- Single trip …. Or not

1-

Pallet

4 ways entry of 2 ways entry





- Loading unit
  - Intermodal transport unit
  - European size containers
    - 45’
  - Swap body
    - To road vehicle dimension
  - Bi modal semi trailer
    - Less used
  - Low floor wagon
    - To carry ITUs
  - Pocket wagon
    - To accept axle/Wheel
  - Basket wagon
    - Demountable subframe
  - Rolling road wagon
    - Low floor wagon for rolling road

Swap body

Pocket wagon

Continental modes

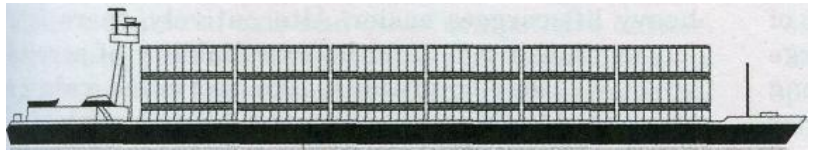
- Short sea shipping
  - Short distances
  - Advantages
    - Energy use
    - Extra capacity
  - Inconvenience
    - Long lead time
    - Low reliability
  - Feeder services
    - Liner services
    - With long distances traffic density decreases
  - RORO services
    - Including unaccompanied intermodal transport
  - Barge
    - Can moor to parallel tracks

Continental modes

- Inland waterway terminal
  - To offer trimodal terminals
- Waterways shipping
    - Intermodal movements by coastal and inland waterways
- European Inland waterway services
  - The Rhine key river
    - Hinterland terminals
    - Number of calls
    - Possible dwell time at sea port
- Rhine and … Danube
  - 2 millions containers estimation in Rotterdam
  - Roll on Roll off to avoid Switzerland for heavy trailers
  - Duisburg
    - From 110000 containers in 1990 to more than 2 500 000 containers today

2-

Different types of inland waterways service



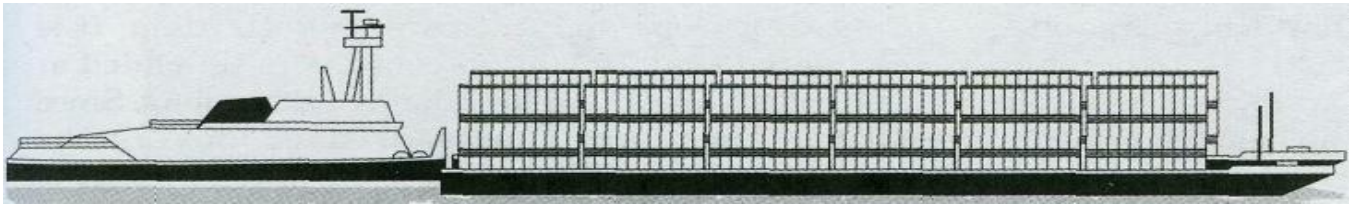
EUROPASCHIP

Typical container capacity per ECMT class.

Class		Typical TEU capacity	Typical TEU configuration (l x w x h)
II	Kampine barge	24	6x2x2
III	Dortmunder	54	9x3x2
IV	European class	90	10x3x3
Va	Rhine vessel	208	13x4x4
Vb	1x2 push barge	384	13x4x4 + 11x4x4
Vla	2x1 push barge	352	Twice 11x4x4
Vlb	2x2 push barge/ largest motor vessel	450-500	

** no container traffic in Classes 0 and I

EUROPEBARGE



KOPPELVERBAND

- Infrastructure
  - Canal, locks and bridges
- River ports to challenge as Duisburg
- IWT Classification examples
- Connecting inland, coastal and ocean services at stake
- European coastal services
  - Developping in the U.S., to make fewer ship calls
  - Bremen to Hamburg and Scandinavian ports
    - 100 to 400 TEUS capacity, more than 16 knots speed
  - Short Sea Shipping Rotterdam
    - Oil, containers, fruits, coal, ore, scrap metal reach in 24 hours European ports
  - Amsterdam Portugal equivalent to 180 000 trucks a year
  - Black Sea: RoRo developping : Turkey, Russia, Eastern Europe
  - Baltic sea more than 400 ports with over 950 millions tonnes a year
- Market rules conditions are depending on ….
  - International Rhine
  - Rhône …
- Larger ocean containerships fewer port calls

Inland waterway network connected to Rotterdam

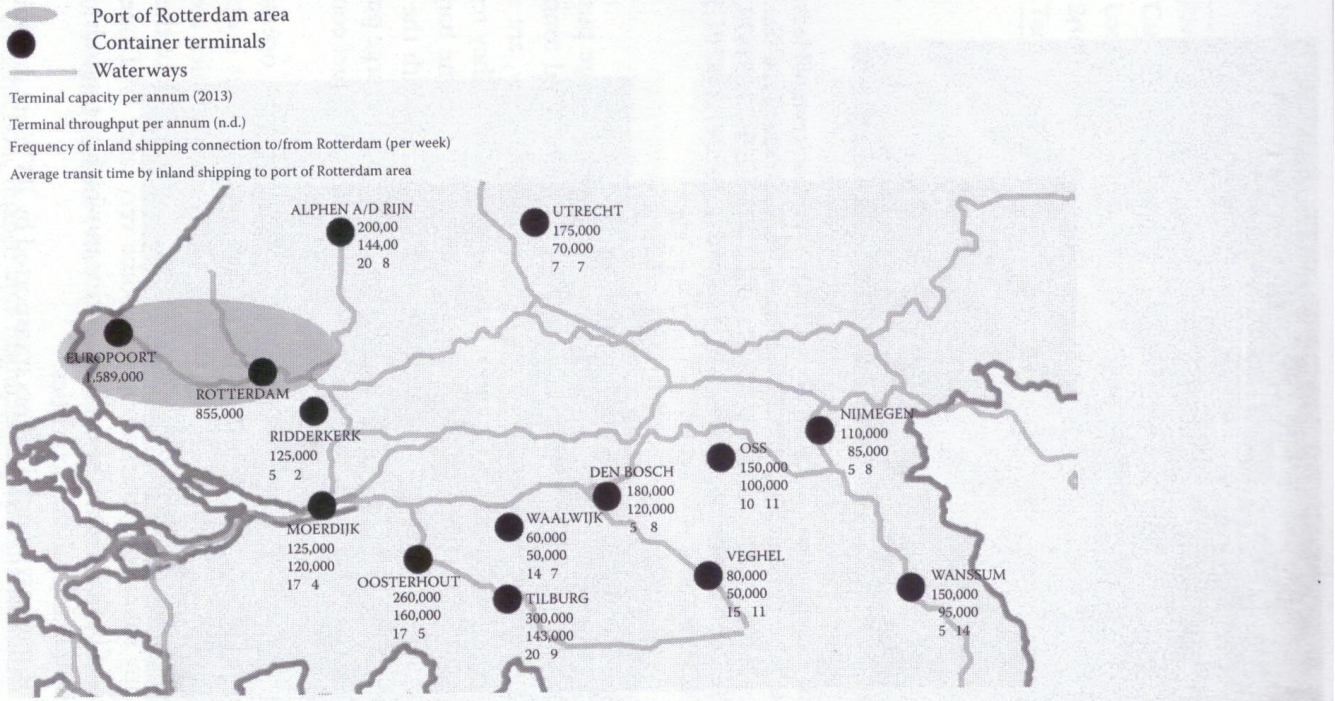


Figure 4.3 IWW network for the Port of Rotterdam. (From Fan, Y., The design of a synchromodal transport system: Applying synchromodality to improve the performance of current intermodal freight transport system, Master's thesis, Delft University of Technology, 2013.)

Table 4.2 Fleet statistics: Number of vessels

	W-Europe	*Europe Danube*	*United States*	*China*
Self-propelled				
Dry cargo	6.753	373	635	n.a.
Tank	1.992	37	2	n.a.
Total#	8.745	410	635	132.000
Push barges				
Dry cargo	3117	2559	23418	n.a.
Tank	155	233	3220	n.a.
Total#	3.272	2.792	26.638	33.000
Pushers	1039	422	3442	n.a.
Total	n.a.	n.a.	n.a.	165.000

Source: Adapted from Hekkenberg, R. and Liu, J., *Inland Waterway Transport: Challenges and Prospects*, Routledge, London, 2016.

IW fleet

4.4 A tugboat pushing barges up the Monongahela. (From https://rutheh.com/2010/03/10/tugboat-pushing-barges-up-the-monongahela.)

Saving load and fuel

Keep in mind global warming and tides as well as water levels

Table 4.4 Factor costs in inland waterway transport (reference date: 2008)

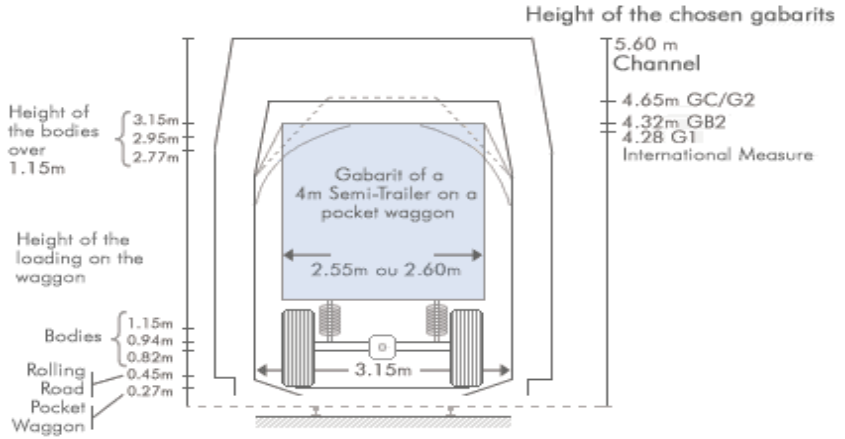
	Measure	*Rhine vessel (Class Va)*	*Rhine-Herne vessel (Class IV)*
Vessel characteristics			
Type of vessel		Motor dry freight vessel	Motor dry freight vessel
Capacity	TEU	208	90
Dimensions (L × W × D)	Metres	110 × 11.40 × 3.60	86 × 10.50 × 3.20
Tonnage	Tons	3.500	2.000
Fixed costs			
Capital costs	€/year	784.750	350.000
Labour costs			
Day operations	€/year	140.000	120.000
Semi-continuous operations	€/year	285.000	250.000
Continuous operations	€/year	660.000	510.000
Variable costs			
Fuel costs			
Loaded vessel	€/km	10	7.54
Empty vessel	€/km	4.78	3.62
Repair and maintenance costs	€/km	0.72	0.37
Overheads	€/year	n.a.	n.a.
Business hours			
Day operations	Hours/year	3.500	3.500
Semi-continuous operations	Hours/year	4.500	4.500
Continuous operations	Hours/year	7.800	7.800
Direct cost hour coefficient			
Day operations	€/hour	264	134
Semi-continuous operations	€/hour	238	133
Continuous operations	€/hour	185	110
Kilometre cost coefficient			
Loaded vessel	€/km	10.72	7.91
Empty vessel	€/km	5.50	3.99

Source: Adapted from NEA (2009).

Discussion

What makes **intercontinental vs continental moves different** as far as transport modes are concerned ?

- Rail movement
  - Infrastructure design
    - Railway track gauge and clearance parameters
    - To 3000 t
    - and 1,27 mm uncertainty
  - The more wheels, the more traction
    - Two bogies : 2 driving axles
    - 20-25t per axle
  - Traffic safety and control systems
    - New infrastructures
    - New freight lines
  - The AGTC network
    - The UIC C Standard clearance gauge, height up to 4 m
    - UIC B to 2.9 m high, containers and swapbodies



GAUGE

PURPOSE BUILT CARS

RAIL

- Penetration lines. Their main purpose is to link a port city with its hinterland, particularly to access natural resources such as minerals, agricultural products, and wood products. The purpose of a penetration line is to convey large amounts of materials in a manner that would be prohibitive for road transport. It also represented one of the initial stages of rail development, notably in the United States, which later became regional networks linked by transcontinental lines. Today, penetration lines are mainly found in developing countries (Africa and Latin America) and were partially the result of the colonial era. Such areas have several gauges and limited cross-border connectivity and thus offer limited competitiveness with trucking.

- Regional networks. They represent well-developed regional networks servicing high-density population areas of developed countries, intending to support the massive shipment of freight and passengers. This network type initially started as penetration lines or interconnected city pairs and evolved to form a lattice. Regions with the highest rail density are Western Europe, the Northeastern part of North America, Coastal China, and Japan.

- Transcontinental lines. These lines were mainly established to improve territorial accessibility and for the setting of national sovereignty. The most relevant examples are in the United States, Canada, Russia, and Australia, which have built rail systems of this scale, such as between New York and Los Angeles, across Eurasia (between Dalian and Moscow), across Southern Australia (Perth and Adelaide) or across South America (Buenos Aires and Valparaiso). More recently, transcontinental rail lines have seen a renewal in interest by their capability to attenuate the discontinuity of maritime transportation by transporting containers such as over the North American Landbridge and the Eurasian Landbridge. They are a chain in the global intermodal transport system.

Rail movement

- *Eight variables influencing capability for freight*
  - Track and route mileage
  - Electrified track miles
  - Permissible line speeds
  - Gauge capability
  - Route availability
  - Length capability
  - Gradients(slope)
  - Total tonnage capability

RAIL

- Lbridges and tunnels
  - the Seikan tunnel between the islands of Honshu and Hokkaido in Japan, with a length of 53.8 km
  - Channel Tunnel between France and England reaches 50.5 km
  - Gotthard Base Tunnel, which opened in 2016, was built mostly to carry rail freight through the Alps, totaling 57.1 km
  - in China. The 1,142 km line links Golmud in Qinghai province to Lhasa in Tibet. Some parts go through permafrost and altitudes of 16,000 feet, conferring its status as the world's highest rail line.

The table below shows some of the network parameters.

Infrastructure parameters for the network of major international combined transport lines

	A		B
	Existing lines which meet the infrastructure requirements and lines to be improved or reconstructed		New lines
	at present	target values	
1. Number of tracks	(not specified)	(not specified)	2
2. Vehicle loading gauge		UIC B[2/]	UIC C [2/]
3. Minimum distance between track centres [1/]		4.0 m	4.2 m
4. Nominal minimum speed	100 km/h	120 km/h	120 km/h
5. Authorised axle-loads:			

RAIL

- overhead clearance inadequate for double-stack trainsfor tunnels and bridges
- several rail companies, notably in North America, have invested massively in double-stacking projects
- economies and improved capacity of double-stacking have justified investments in raising the clearance from 5.33 m (17’6”) to 8.1 m (20’6”) along major long-distance rail corridors
- Europe is less advanced
  - Clearance thus forbids the usage of double-stacking on most European rail corridors
- China, doubles-staking corridors are under development, particularly between major container ports and inland cities, but their use remains limited.
- Another salient example of a 75-km double-stacked corridor is across the Isthmus of Panama, allowing it to support canal operations as a portage option.

COST ANALYSIS France €

	Long distance	Exchange	Combined
Distance cost	457.15	453.29	36.86
Driver cost	200.54	182.41	79.08
Structure cost	154.07	77.04	35.68
Valenton 94 / Avignon			450
TOTAL	811.76	712.74	601.62

Locomotives

- Old locomotives : up to 30-40 years
  - Power supply systems
    - With different electric systems
    - 4000 KW power (5400 Horse power)
    - Till 10000 KW
- But in intermodal …
  - 1000-2000 t payload in Europe and heavier in North America
  - The tailormade locomotive cost is 2-4 million € (leasing way)
  - Diesel locomotives are used for handling equipment

Table 2.5 UIC wagon codes

Class	*Wagon type*
E	Ordinary open high-sided wagon
F	Special open high-sided wagon
G	Ordinary covered wagon
H	Special covered wagon
I	Refrigerated van
K	Ordinary flat wagon with separate axles
L	Special flat wagon with separate axles
O	Open multipurpose wagon (composite open high-sided flat wagon)
R	Ordinary flat wagon with bogies
S	Special flat wagon with bogies
T	Goods wagon with opening roof
U	Special wagons
Z	Tank wagon

Figure 2.20 Open wagon with tarpaulin cover. (From Wascosa.)

Wagons

- Rail freight operators **often lease wagons** from manufacturers or leasing companies
- Locking pins are used depending on the loading unit (swapbody, container …)
- In UK conveyance of 9’6’’ is too constrainted (low floor or pocket wagons)
  - But existed 60’ long wagon : 1x20’ + 1x40’

Figure 2.21 Open wagon. (From © Phil Sangwell [CC BY 2.0] via Wikimedia Commons.)

Figure 2.22 Covered wagon being unloaded by a forklift. (From Port of Gothenburg.)

Figure 2.23 Powder wagon. (From Wascosa.)

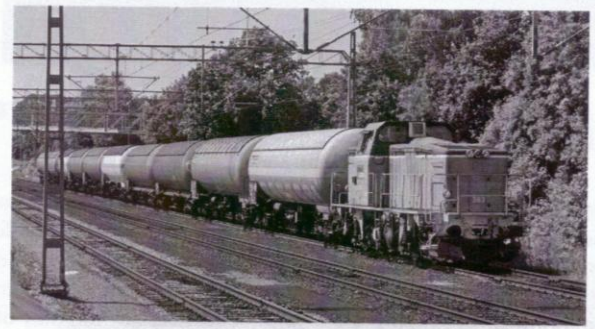
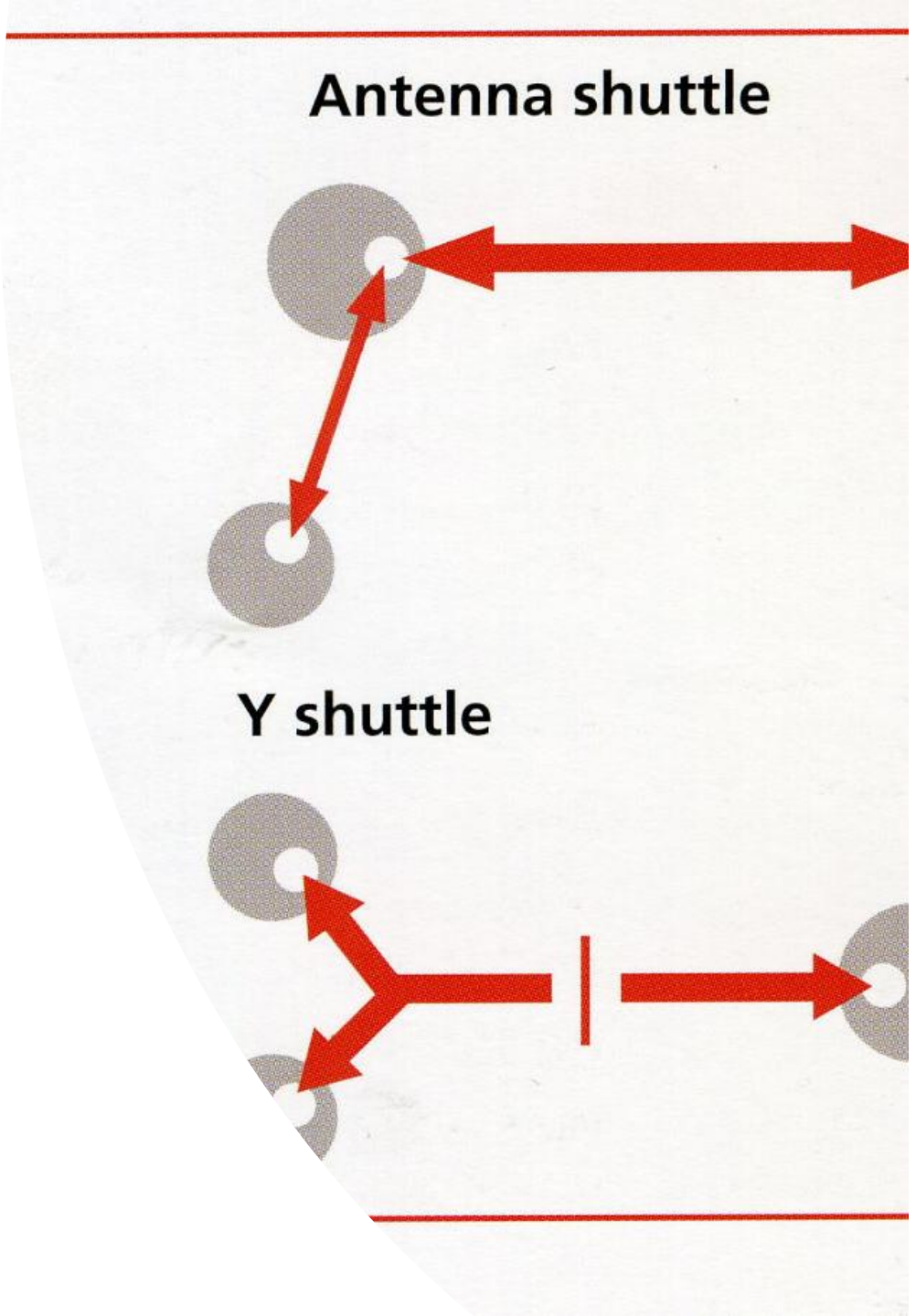


Figure 2.24 Tank wagons. (From Port of Gothenburg.)

Figure 2.25 Flat wagon with uprights for hauling general cargo such as steel pipes. (Fro Port of Gothenburg.)

- Rail shuttles
- Block trains (not fixed)
- The antenna shuttle and Y shuttle
- The hub and spoke system …
- The gateway system
- Shuttle network
- Single wagon production
- Trimodal production systems
- Rail corridors
  - Rotterdam Genoa
  - Compatibility



- Rail road
  - Swap bodies
    - minimal upper body
    - cannot be stacked
    - It is one type of standard freight containers for road and rail transport. Many swap bodies are fitted with four up-folding legs under their frame.These legs make it possible to change, or swap, their body from one carriage to another, or to leave the swap body at a destination, without using extra equipment such as crane or hoist.
  - Piggyback
    - combination
    - speed and reliability
    - with Trucks
    - trailer train
    - Using concept of long haul /short haul (Rail/Road mode) which is popular in Europe. The goods are packed onto the trailer and the trailer is moved to rail flat car for final station, then truck will continue carry the goods to final destination
  - Rolling road
    - combined transport
    - without comitting to specific investment
    - mobile ramps
- Outlook
  - E.U. standard to 775m train length

PIGGYBACK

SWAPBODY

MT COURSE Frédéric Gauthier

RESEARCH WORK

WORKING GROUP FOR NEXT TIME

- LET'S COMPARE MAIN INTERMODAL RAIL ROAD OPERATORS ON THE UK MARKET
  - IDENTIFICATION
  - WEAKNESS AND STRENTGH

- Landbridge train
  - European rail shuttle
  - Combine their management of the inland movement of container
  - East west trade in Europe
  - Door to door services
  - Russian railways joint venture : 2 Block trains a week
  - China and Russia developing agreement
  - Transport corridor Berlin-Warsaw-Minsk-Moscow
  - Transalpine traffic, Chunnel …
  - Malaysia a daily train to ICD
  - USA, double stock container service in South California

Belt and Road Initiative China/Europe

** CO2 : moyenne en grammes / tonne - kilomètre (source : OCDE 2008)*

Import China - Europe		
TC 40' (25T)	**SEA FREIGHT**	**RAIL FREIGHT**
Leg	Shanghaï - Hambourg	Shanghaï - Duisbourg
Distance	22 735 km	8 838 km (- 60%)
Carbonic gas emission*	12,5 g/t-km = 7,1 T	30 g/t-km = 6,63 T (- 6.6%)
Transtit time (days)	32	19 (- 40%)
ALL IN	1 950 USD	5 575 USD (x 2,85)
Fréquency (/week)	1	6

TYPE	LENGTH M	WIDTH M	HEIGHT M	VOLUME CBM	DEAD WEIGHT	LOAD T
box	7,15	2,55	2,30	39,3	NA	NA
tautliner	13,6	2,55	2,3to2,49	77	4to4,5	28,5
tarpaulin	13,6	2,55	2,35	77	3,4	NA
reefer	13,6	2,6	2,6	variable	5to5,5	28
Mega volume	13,6	2,55	2,95	100	5,85	28

Caisses mobiles fourgon 7,45 m

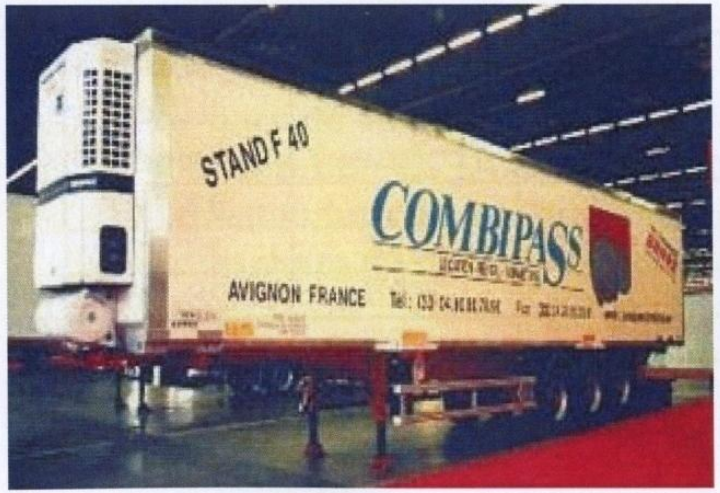
Caisse mobile tôlée

Caisse mobile 30’

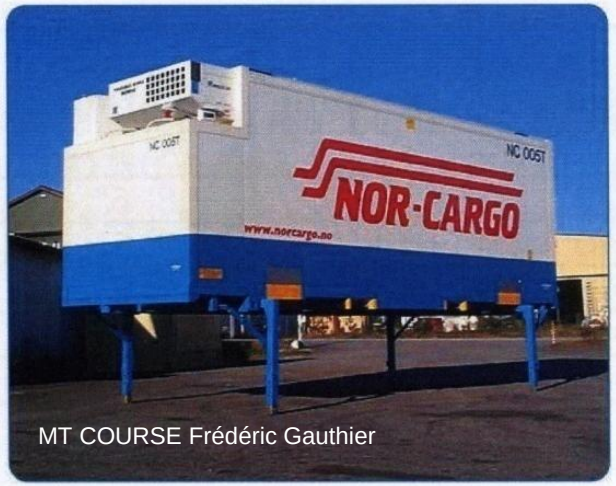
Caisse tautliner 13,6 m

Caisse mobile 7,45 m

Caisse frigo 13,6 m



Caisse frigo 7,45 m



Caisse Mega-Com

MT COURSE Frédéric Gauthier

Loading units comparison

	Number of pallets 80x120	Number of pallets 100x120	Load
Trucks Rail car SNCF	Till 33 44	Till 26 36	25.5 t 40t (average)
Container 20' Container 40' Swapbody TRAIN LENGTH	11 25 33 750 m to 850 m	9 22 26	28 28 29 1,800t
Unit type Combined container Swapbody CEMT Swapbody A1219 Swapbody A1360	External dimensions Wide x high x long 2.5x2.59x7.45 2.5x2.67x7.45 2.5x2.67x12.192 2.5x2.67x13.6	Euro pallet 18 18 30 33	UK pallet 14 14 24 26
Disruption to solve			
Bulk	Dedicated handling equipment	To move to containers	To transform raw material from close storage place
Pallets / big bags … Containers	Forklift Simple but dedicated	Handling equipment on barge with working operations Gantries, infrastructures	Storage / consolidation/ cross docking Close to consuming area Customs /ICDs availability
Heavy packages	High cost handling infrastructures	Disruption, horizontal handling RoRo	Useful inlandwaterway combined with road transport on short distances

Road transport systems

- Large scale to large operators
- Flexibility
- Production system with large customers
- Terminal cartage solutions
  - C passed on to the consignee
  - Extremely short, short, long distances
- Intermodal production and chain integration
  - Organizational and commercial ones
- Local distribution and flexibility

Road

- New materials (ceramic, plastic, aluminum, composite materials), fuels (electricity, hydrogen, natural gas
- information technologies (vehicle control, diagnostic, location, navigation, and toll collection) are continuously integrated into road vehicles
- Countervailing forces are at play, such as congestion, the aging of the population, and even information technologies (teleworking). For trucking, demand continues to grow, driven by rising incomes, global supply chains, and e-commerce.

Efficiency model for road transport

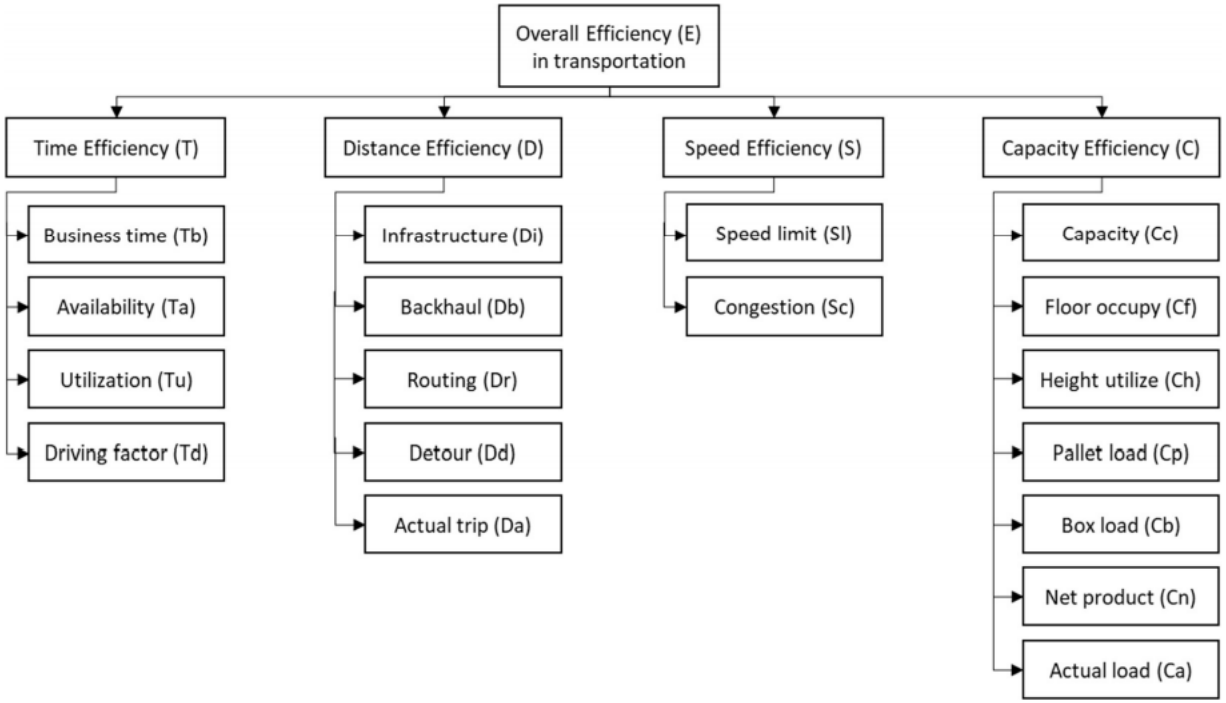


Figure 2. 1 Four-dimensional overall efficiency model for road transportation

Source: (Samuelsson and Tilanus, 1997)

Challenges to integrate pre and post Haulage

Road is 73% of inland E U freight

E U goal 30 % road freight shifted to other modes by 2030

Offer fragmented so Many empty trips

so pre post carriage can be primary source for long transit time and lead time unreliability

Urban distribution

Availability of infrastructures

Concentration of freight demand

Congested roads including with Cars

Road terminals are easily location changed which is not the case for rail terminals

Having closer terminals to shippers and receivers will decrease PPH (delay) cost and Congestion

But these networks are separated

Road focus

MT COURSE Frédéric
Gauthier