Rail logistics for an efficient supply chain management

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Introduction

- Railway transport - key part of the logistics chain of supermarkets and third party logistics providers
- Rail transport is an ecological and a convenient way for delivering large amounts of freight
- This paper presents the benefits of choosing railway transport in supply chain, benefits reflected in customer's satisfaction and describes automatic systems that avoid or reduce train delays.

Comparison matrix for different transport modes

MODE / CRITERIA	ROAD	RAIL	SEA	AIR
Relative speed	Moderate	Moderate	Slow	Very high
Reliability	Good	Good	Limited	Very good
Cost per tonne/km	Medium	Low/medium	Low/very low	High
Flexibility	High	Low	Low	Medium
Other considerations	Extensive network	Limited and fixed infrastructure	Restricted network	Limited network
	Short and medium distances e.g. Europe/Middle East. From a neighbouring country to operation site Internal transport; Short/medium distance	Large consignments. From port of discharge to inland operation site (warehouse). Ecological.	Large quantities; Less urgent; Pre positioning phase; Second phase; Long distance with no time constraint.	Emergency phase; Expensive goods; Fragile or perishable goods; Cold chain; No alternative option; Small shipments; e.g. diplomatic pouch; Long distance with time constraint.
Advantages	Relatively fast; No transhipment; Direct delivery; Flexible; Cost.	Economical; Large loading capacity; Range and speed (in most countries).	Economical; Large loading capacity; No restriction on loading capacity; Cheap.	Fast; Reliable; Limited losses; Direct; Easy tracking and tracing.
Disadvantages	Roads may be dangerous (land mines) or blocked (rainy season); Sometimes, driver's nationality or vehicle registration not acceptable	Difficulty finding freight cars; Delays; Transhipment; Inflexible; Tracking.	Slow; Transhipments at ports; Use as a second means of transport for large volumes; Higher theft risk in the port; Not flexible.	Expensive; Restricted to journeys between airports; Restricted loading capacity (dangerous goods, size of shipment, weight, fuel, size of packages, etc.).

Source http://log.logcluster.org/

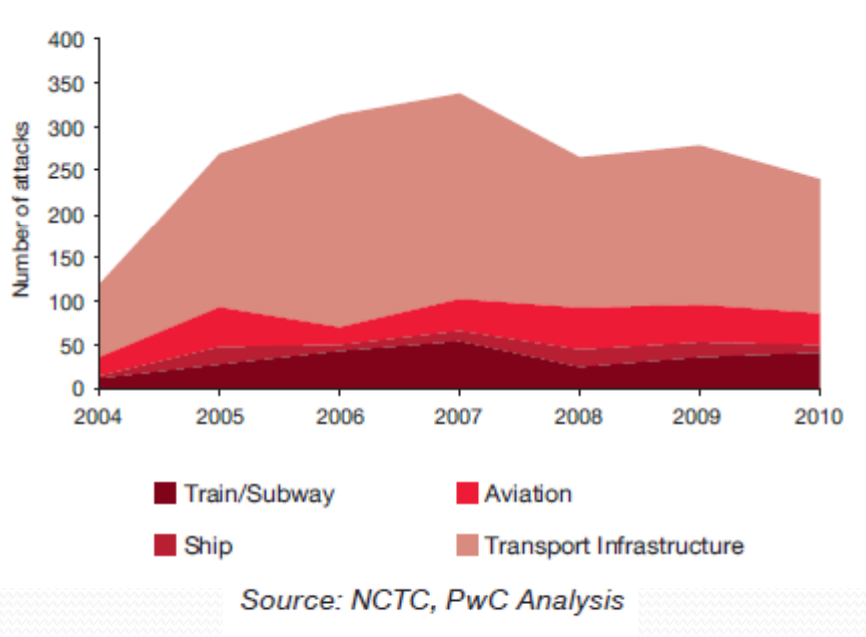
Customer's satisfaction

Customers are interested in an unaltered product, with no harm caused by transport. They are interested in a prompt delivery and search for a smaller price for transportation.

Important transport aspects

- Security
- Cost
- Time (delays)

Supply chain security



Source: NCTC, PwC Analysis

Supply chain disruptions or freight damage can be caused by:

- Attacks
- Natural disasters

- 2010- 3299 attacks
- Data security - Cyber attacks
- Rail – Safer transport mode

Cost aspect

For long distances, the supply chain requires a secure and fast transportation mode:

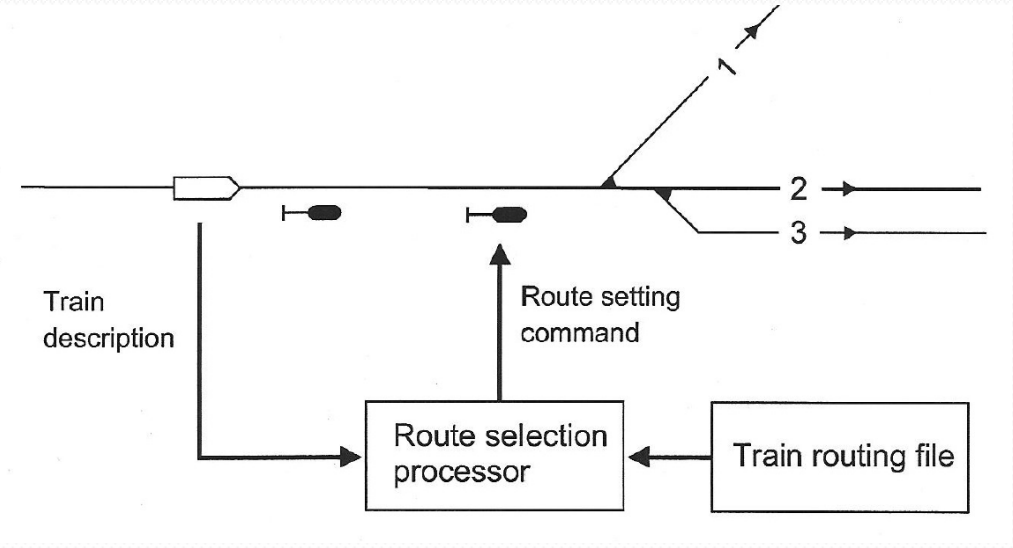
- Airplane
- Train

- Alternative - High Speed Railway (convenient, ecological)
- In 2010, 40% of transport traffic over medium distance is provided by High Speed Rail

Time aspects

- Supply chain - strictly plan freight
- Reducing delays - new automation systems for identifying trains and routing them towards destination:
  - Train describer – Automatic Train Tracking
  - Automatic Route Setting
  - Railway traffic Optimization by Means of Alternative graphs (ROMA)
    - Real time traffic optimization – rescheduling, rerouting trains
    - Train speed coordination

Automatic Route Setting - ARS



Source : Pachl, 2002

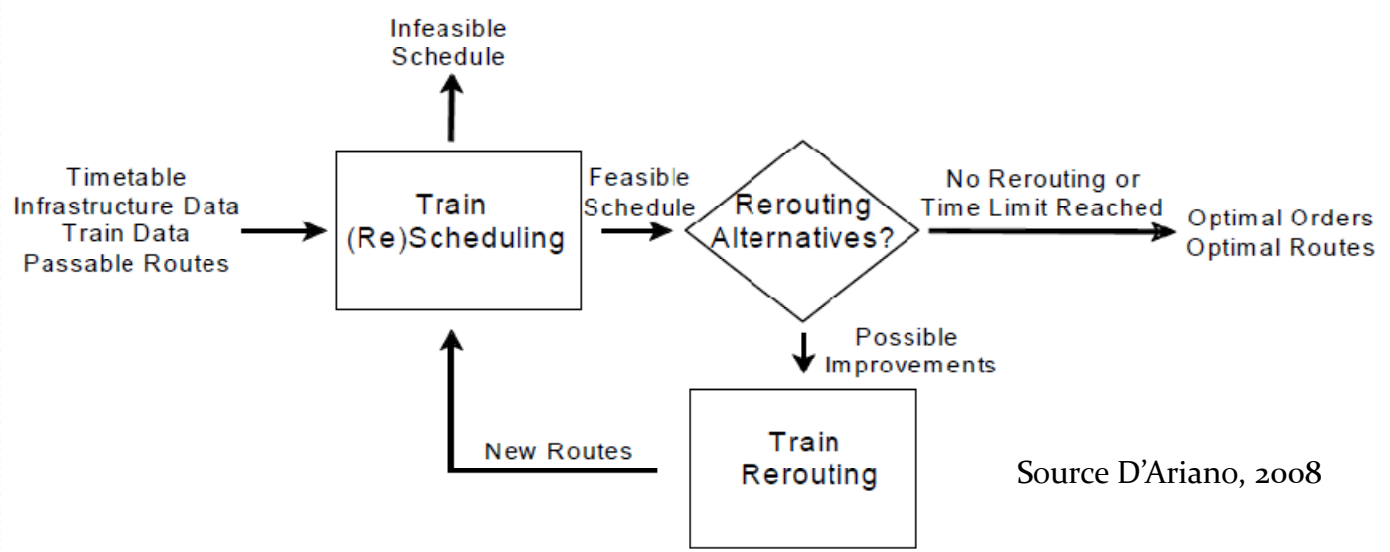
- New detection technology – train describer
- Avoiding route conflicting in advance

ROMA system

Railway traffic Optimization by Means of Alternative graphs

- real-time traffic optimization
  - Rescheduling trains
  - Rerouting trains
- Train speed coordination

Real time traffic optimization – rescheduling, rerouting trains



Source D'Ariano, 2008

- The systems use a timetable and a set of alternative routes for every train passing through the station.
- When finding a dead-lockt he system checks if rerouting the train leads to a better solution.

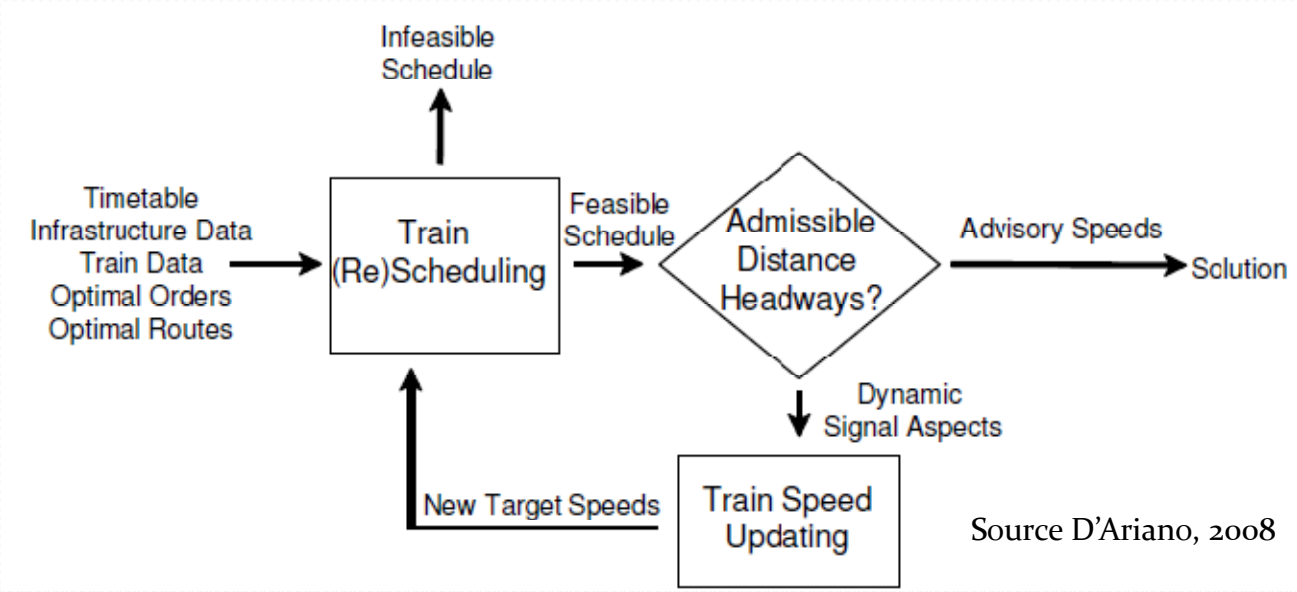
Performance of ARS system, and rescheduling and rerouting trains algorithm

Roma Configurations	Max Cons Delay	Avg Cons Delay	Total Comp Time	% Train Route Changed	% Train Orders Changed
Automatic route setting (ARI)	342.0	38.7	4.8	-	12.3
Scheduling Algorithm (BB)	246.4	27.8	3.9	-	16.9
Rerouting Algorithm (TS)	238.7	24.6	127.9	15.5	12.2

Source D'Ariano, 2008

- In the process of rescheduling, the maximum delay decreases significantly, and by rerouting, a new smaller delay time is obtained.

Train speed coordination



Source D'Ariano, 2008

- When minimizing distances between trains, the line supports as many trains as possible

Conclusions

- Railway transport - important step in the supply chain - cargo can be transported over long distances with minimum effort and low costs
- Customer is interested in receiving quality products at the best price. He desires a good transport: quick and delivering unaltered cargo.
- High Speed Rail represents a good alternative to air transport (more ecological than air transport)

Conclusions

- Need of punctuality accomplished: automatic railway systems that reduce delays through rescheduling and rerouting trains
- Systems avoid human error, increase train speed and decrease arrival time.
- The new technologies provide better systems, new capacity of solving problems and real time solutions.
- Railway transport continues to be, thanks to new optimization tools, a feasible and efficient means of transportation, ideal in supply chains that involve the transport of large quantities of cargo over long distances, with minimum costs and environmental effects.

Acknowledgement

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Thank you for your attention!