



BRAIN-TRAINS

Belgian research action through interdisciplinary networks – transversal assessment of intermodal new strategies

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Workshop BRFF, 24/9/2020





Agenda

Introduction

- **Introduction**
 - Problem statement
 - Project context and research goal

Part 1

- **Part 1: SWOT analysis**
 - Methodology
 - Results

Part 2

- **Part 2: Scenario development**
 - Methodology

Findings

- Results



Introduction – Problem statement

Introduction

Part 1

Part 2

Findings



- European Commission **White Paper** 2011:
Roadmap to a Single European Transport Area –
Towards a competitive and resource efficient transport system
- **Goal:**
 - 30% of road transport over 300 km towards rail and inland waterways by 2030 (50% by 2050)
 - In a context of growing transport demand
 - With a 60% emission reduction target





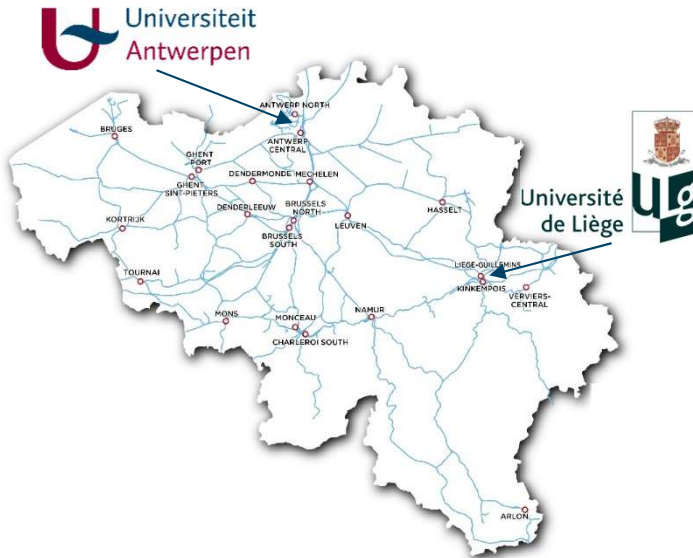
Introduction – Project context and research goal

Introduction

Part 1

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Findings



Scenario's & SWOT

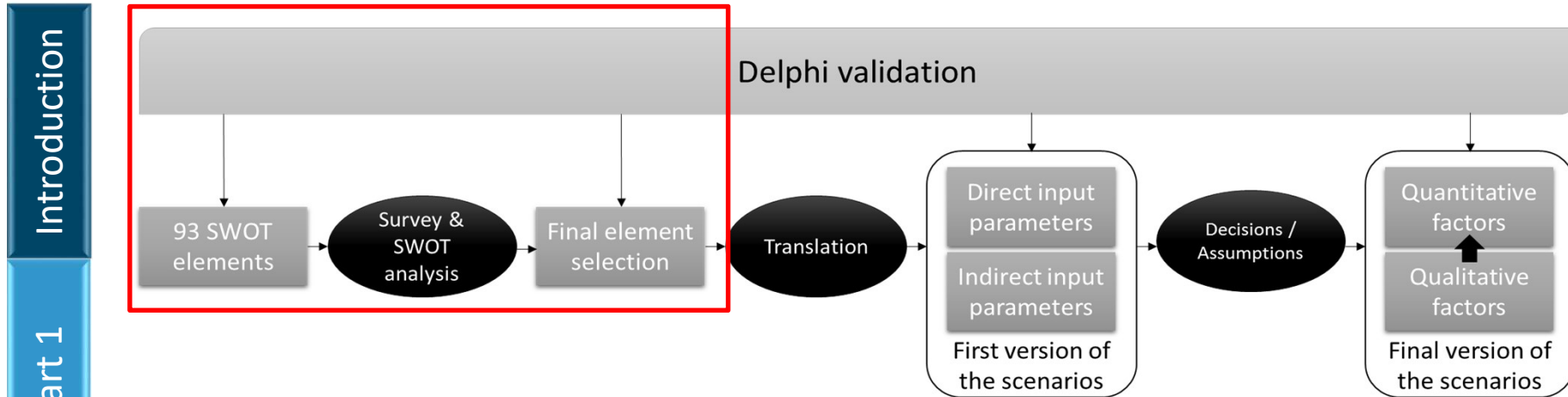
- Optimal corridor and hub development
- Macro-economic impact
- Sustainability impact
- Market regulation
- Public administration and governance



- **Effect** of possible rail freight transport developments
- Operational **framework** with indicators
- Define **strategies** to create success story



1. SWOT analysis - Methodology



- SWOT development: **Delphi-technique**
- SWOT Survey: **Frequency tables, Modus & H-index**

➔ **17 final SWOT elements**



1. SWOT analysis – Results

Introduction

Part 1

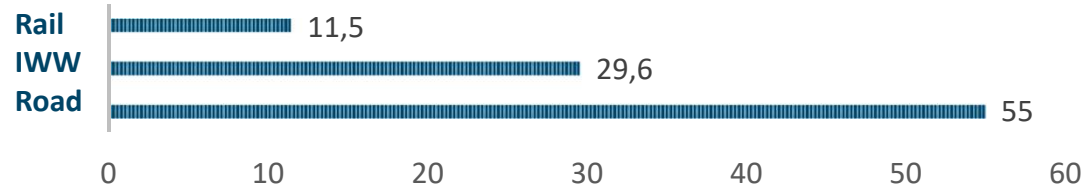
Part 2

Findings

- **STRENGTHS**

- Larger **capacities** and higher payload of containers
 - Economies of scale
- Reduced costs and **externalities** (over long distances)

Direct emissions
(CO₂ in g/tkm)
Source: Ecoinvent (2014)



- **Liberalization** of the market
 - In Belgium started since 2007
 - 2017: 12 licensed operators
- Relation between **GDP** and rail freight / intermodal transport
 - Mutual relationship
 - Decoupling



1. SWOT analysis – Results

Introduction

Part 1

Part 2

Findings

- **WEAKNESSES**
 - Weak network access and lack of **flexibility**
 - Long life-cycle of equipment & infrastructure
 - Priority of passenger traffic
 - Time necessary to book a slot
 - Low network accessibility
 - High **investments** & high **operating costs**
 - Collection, distribution, hauling and transshipment
 - Complex **pricing strategies**
 - Difficult to compare alternative options
 - Missing (capacity) **links**
 - Will be resolved ?



1. SWOT analysis – Results

Introduction

Part 1

Part 2

Findings

- **OPPORTUNITIES**
 - **Consolidation** of flows
 - Economies of scale
 - A **Single** European Market / Transport Area
 - European freight corridors
 - One-stop-shop
 - Future **road taxes**
 - Decreasing road attractiveness
 - **Standardization** and interoperability
 - Increased flexibility and service level



1. SWOT analysis – Results

Introduction

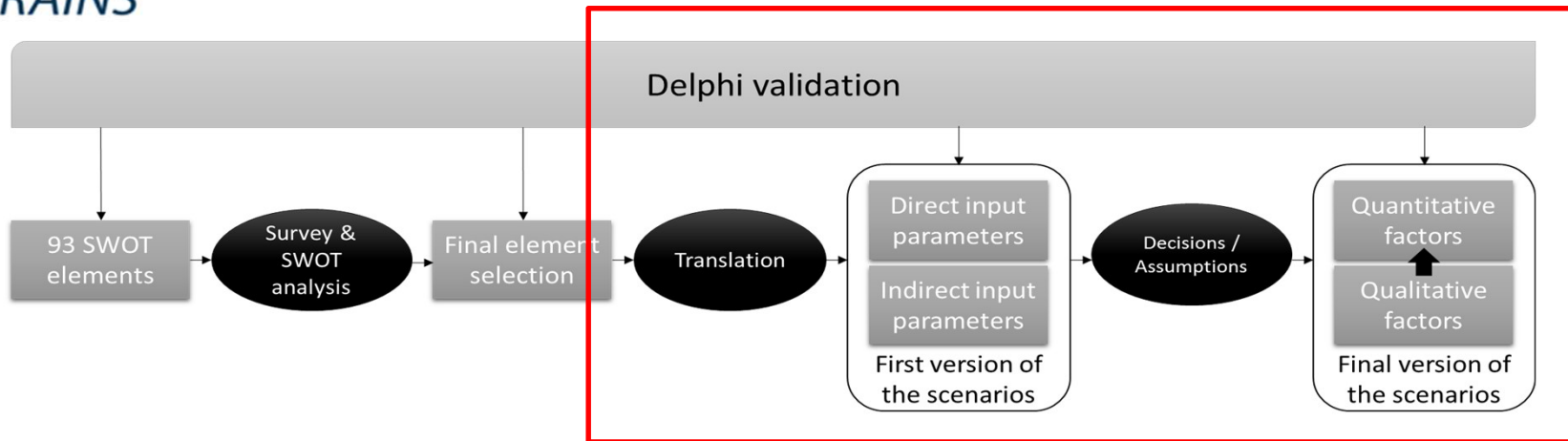
Part 1

Part 2

Findings

- **THREATS**
 - **Savings**
 - Slow modernization
 - Cancellation or delay infrastructure projects
 - **Impossibility** to consolidate / Low interoperability
 - Limited cooperation
 - **Passenger traffic** interference
 - Priority regulation
 - European **monopoly** / duopoly
 - A good or a bad thing ?

2. Scenario development - Methodology



- Limited number of parameters – Three scenarios (Best/Medium/Worst)

-  Explorative, plausible future developments, consistent

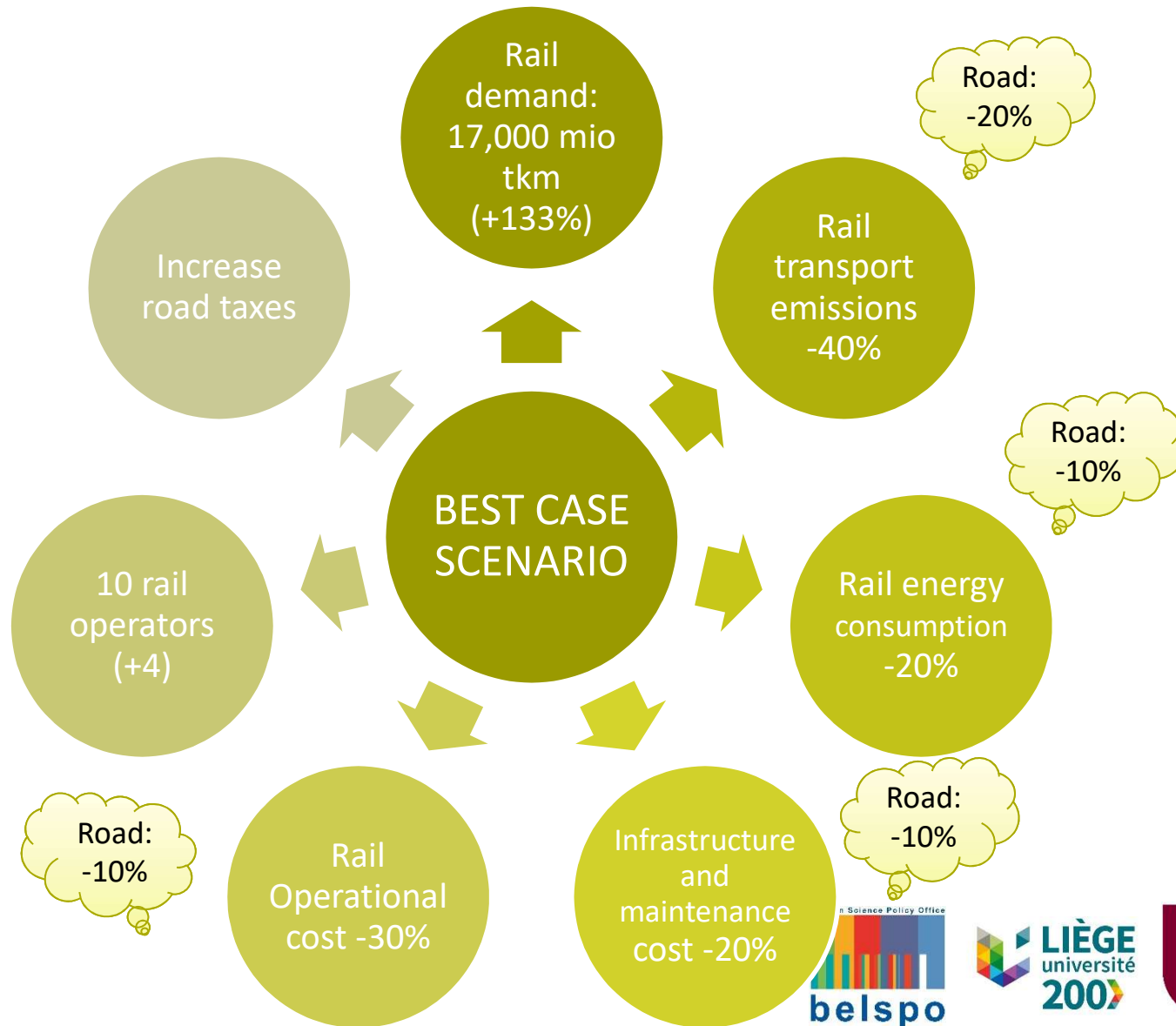
-  Forecasting, predictions

- Time horizon: 2030

2. Scenario development – Results

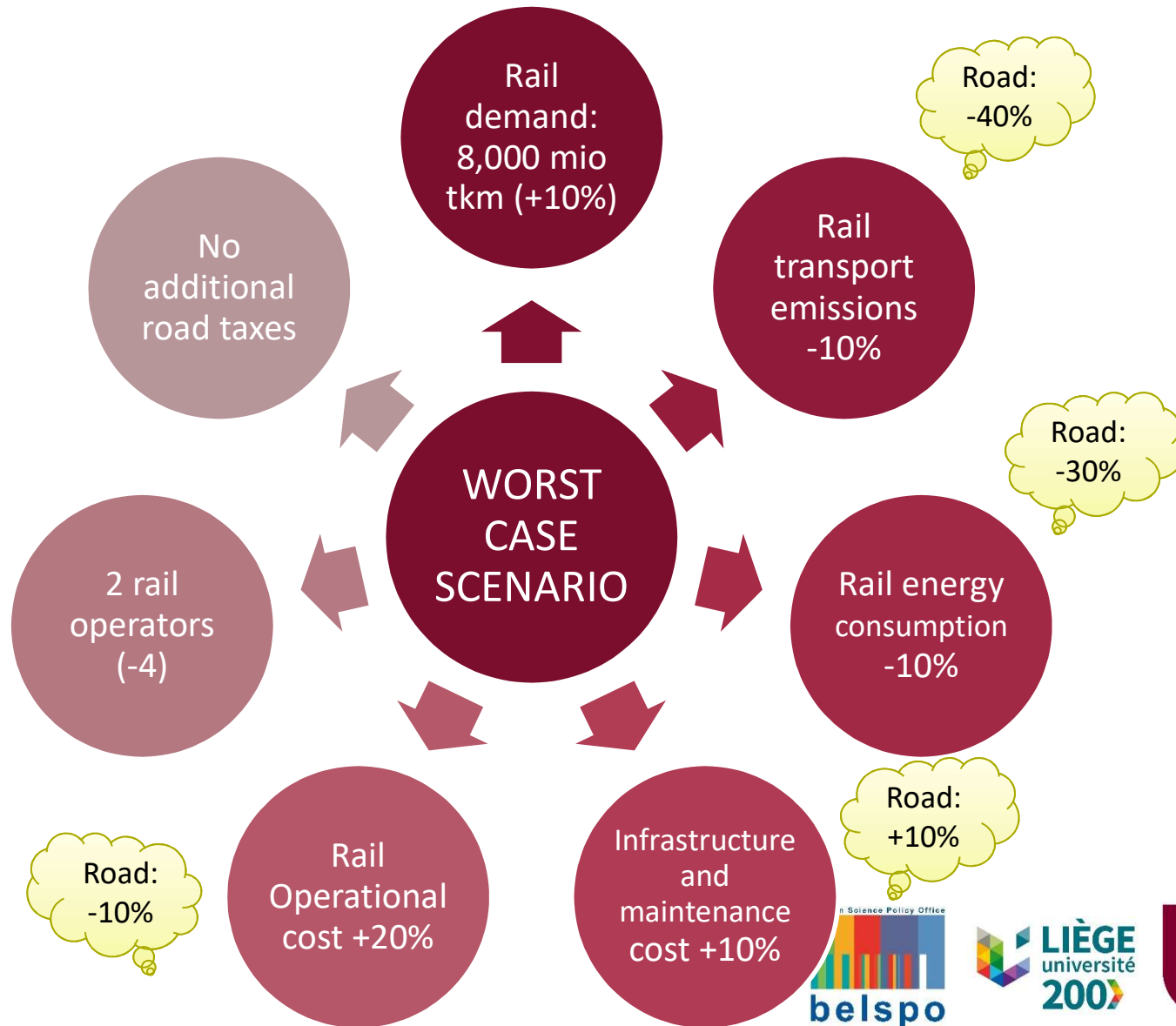
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White Paper (EC 2011) shift goal : ACHIEVED



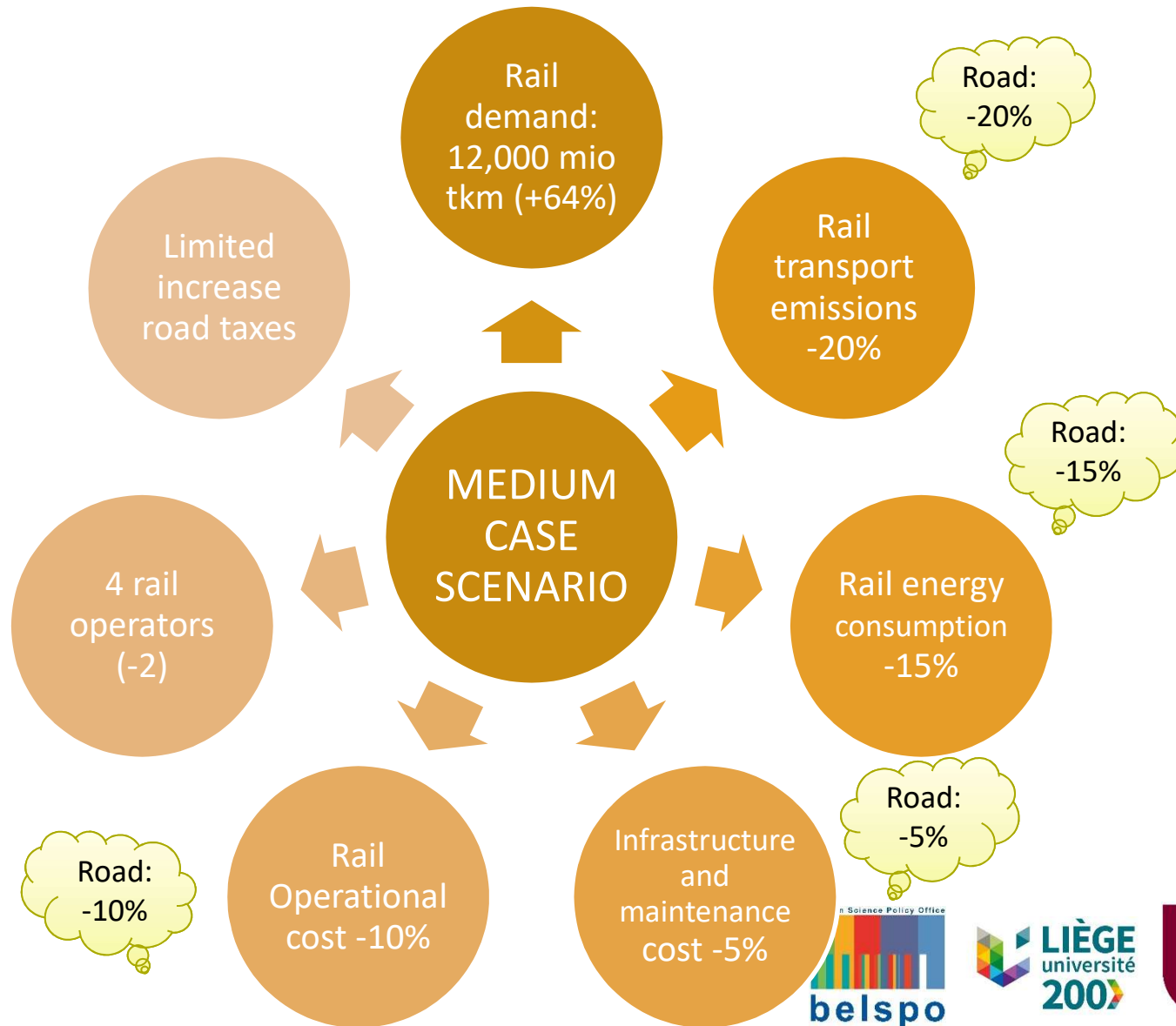
2. Scenario development – Results

White Paper (EC 2011) shift goal : NOT ACHIEVED



2. Scenario development – Results

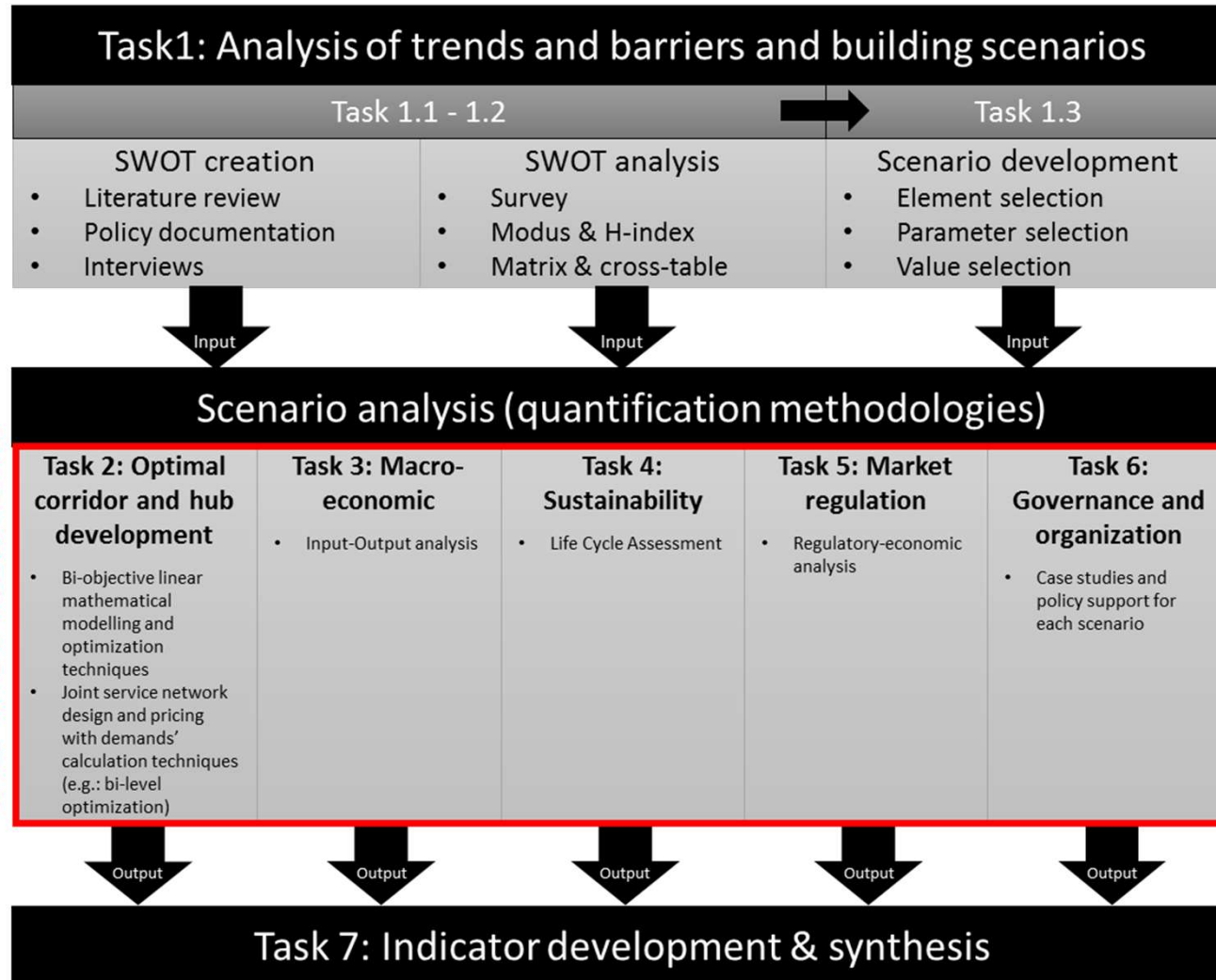
White Paper (EC 2011) shift goal : IN PROGRESS





3. Findings

- Introduction
- Part 1
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- Findings



BREAK-OUT SESSIONS





3a: Optimal corridor and hub development

Introduction

Part 1

Part 2

Findings

- **Objectives:**
 - To simulate the optimal setup of national and international intermodal rail freight corridors.
 - To give cost modeling insights to achieve more educated decisions in the future scenarios.
- **Methods:**
 - Operations Research.
 - Numerical optimization.
- **Points of focus from the SWOT analysis:**
 - Reduced costs and externalities
 - High operating costs.
 - Complex pricing strategies.

Strengths

Weaknesses





3a: Best case: Main conclusions

Introduction

Part 1

Part 2

Findings

- Order of economic preference/affordance: road, IWWs then rail
-> *high rail fixed costs*.
- Positive effect of *road costs*, *IWWs costs* and *road taxes* parameters in the best case. However, overall application yields a more costly position.
- A directly proportional relation exists between the intermodal market share and the corresponding competition's trucking price and market size.



3a: Best case: Main conclusions (b)

Introduction

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Part 2

Findings

- Positive effect of rail subsidies in the first stages; stagnation reached if continued, particularly in the best case.
- The competitiveness of intermodal transport is sensitive to the paths' structure; namely, the distance limits imposed on the road parts -> *pre- and post-haulage*.



3a: Worst case: Main conclusions

Introduction

Part 1

Part 2

Findings

- Worst-case scenario: intermodal market share decreases for economic and environmental optimizations
- The followed policy influences the modal split:
 - Economic optimization: road transport
 - Environmental optimizations: intermodal rail transport
 - Different modal transfers from the reference to the worst-case scenario:
 - Economic optimization: between road and intermodal transport
 - Environmental optimizations: within intermodal transport



3a: Worst case: Main conclusions

Introduction

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Part 2

Findings

- Road taxes
 - Decrease of road market share but not as high as environmental optimizations
 - Lower effect on road market share in the worst-case than in the reference scenario
- Takeaways
 - Influence of the policy on modal split
 - Expected increase of the road market share if the objectives of the White Paper are not taken into account
 - Necessary to adapt the tax instrument to the economic conditions under study



3b: Macro-economic impact: Introduction

Introduction

- Why an economic analysis?

- Freight transport ↔ Rest of the economy
- Direct ↔ Indirect
- Economic value ↔ Strategic significance

Part 1

- Objective

- Quantify **direct & indirect** economic impact
- Analyse **company & sectoral** level
- Development of **economic indicators** based on added value and employment parameters

Part 2

Findings



3b: Macro-economic impact: Direct economic impact

Introduction

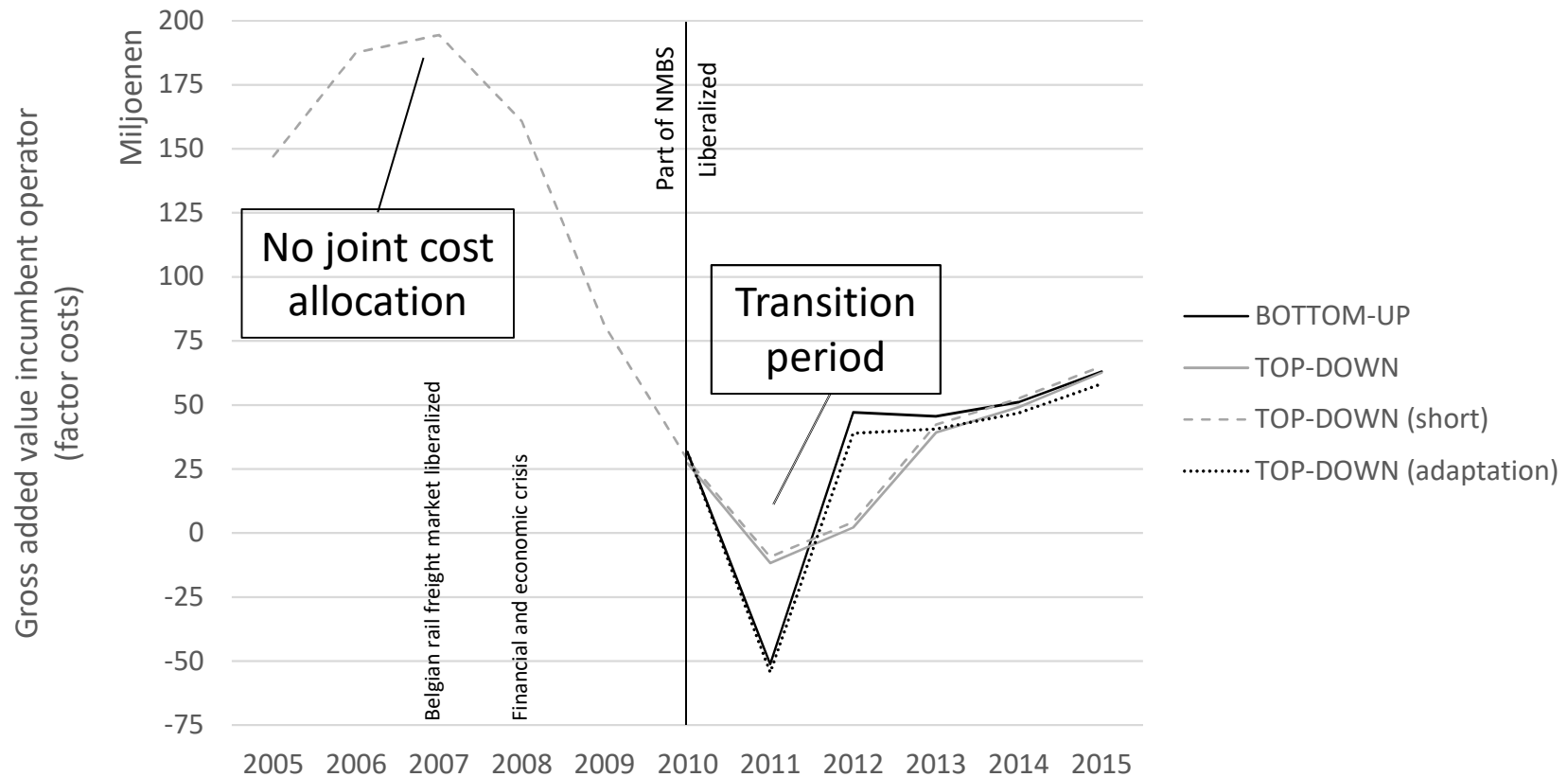
Part 1

Part 2

Findings

- Results

- Gross added value in factor costs (incumbent operator)





3b: Macro-economic impact: Direct economic impact (2)

Introduction

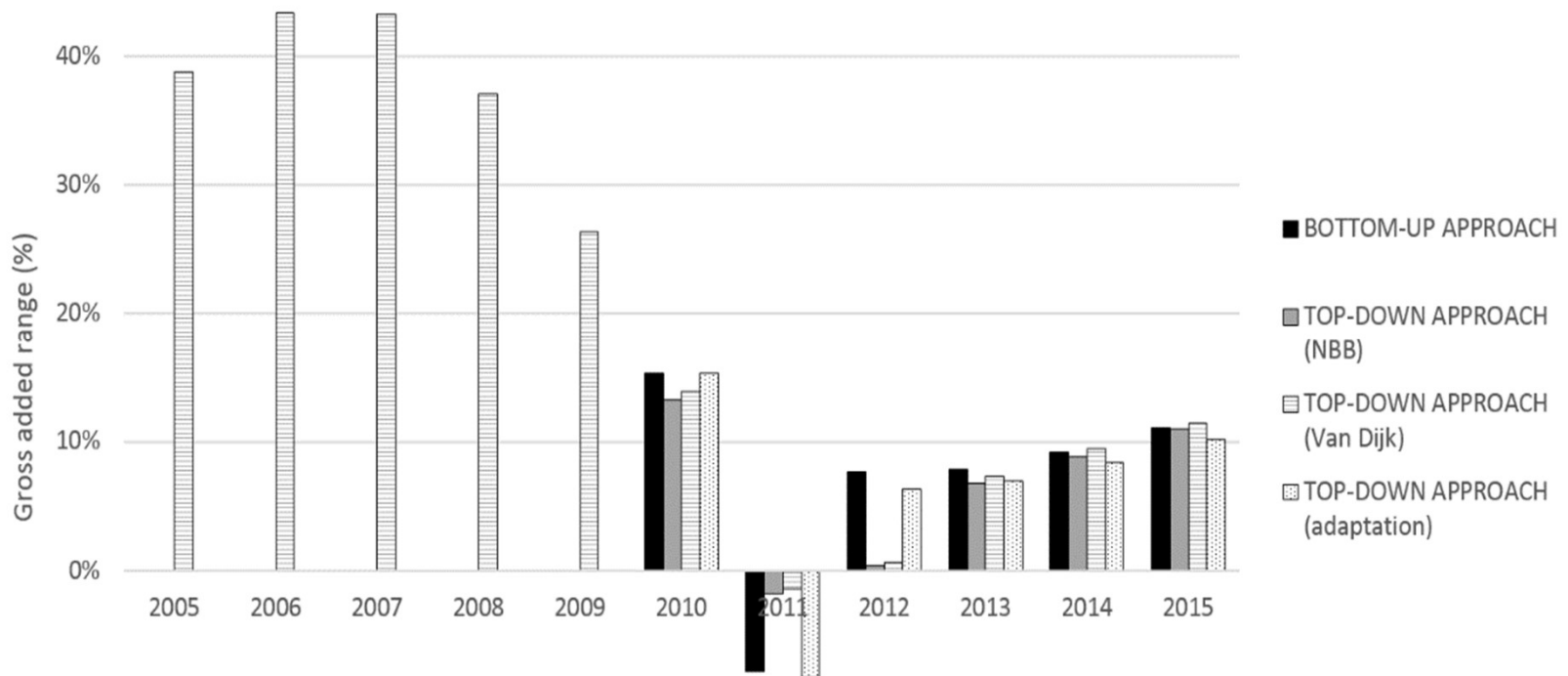
Part 1

Part 2

Findings

- Results

➤ Economic indicators (incumbent operator) – Added value range





3b: Macro-economic impact: Indirect economic impact

Introduction

Part 1

Part 2

Findings

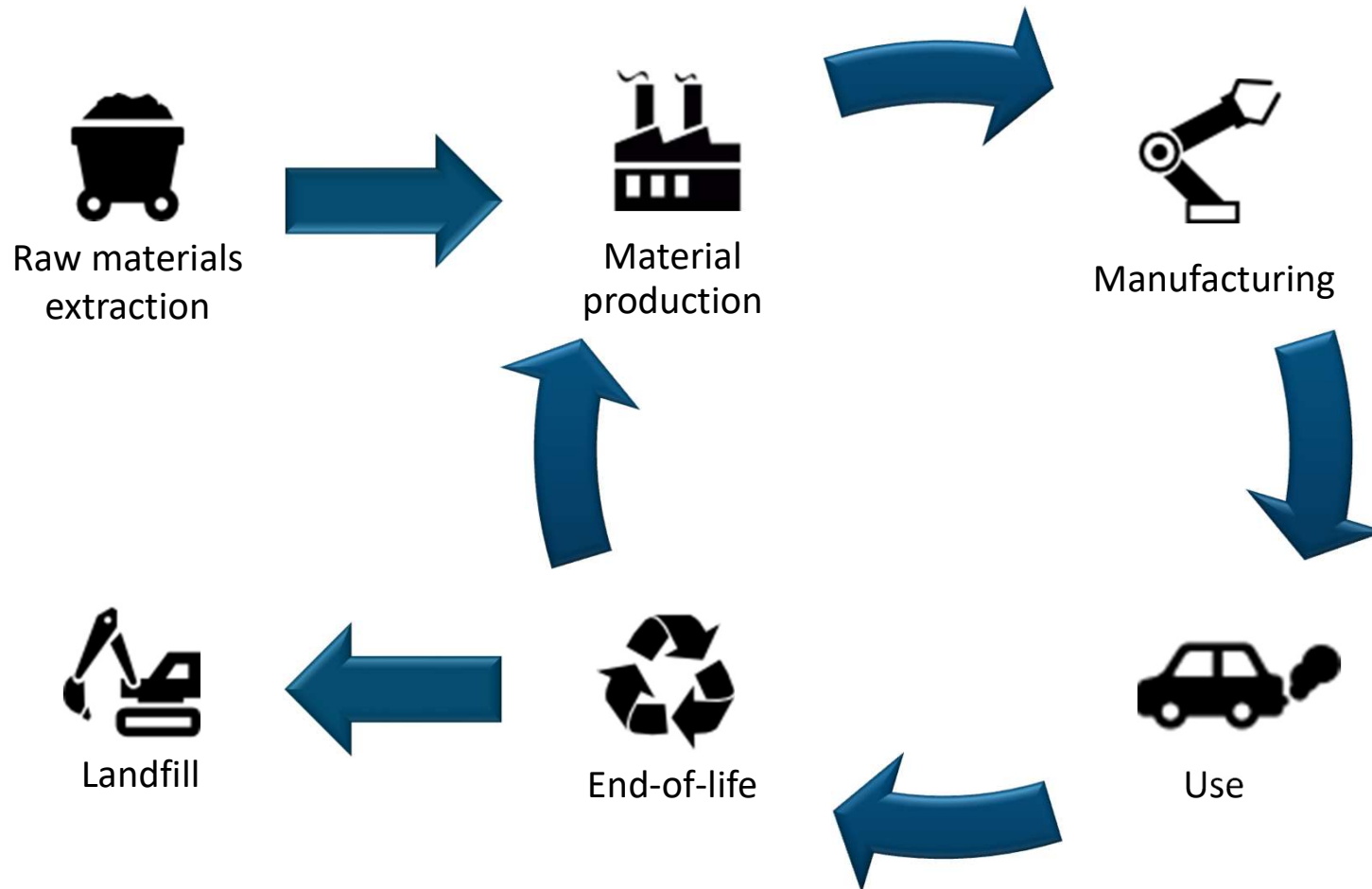
- Results:
 - **Input**
 - Strong link with other land transport, transport supporting activities & business administration
 - **Output**
 - Strong link with other land transport, transport supporting activities & metal industry
 - **Leontief** approximation
 - Rail freight transport multiplier = 2.985
 - Other sectors: average Δ from original = 0.02



3c: Life Cycle Assessment (LCA)

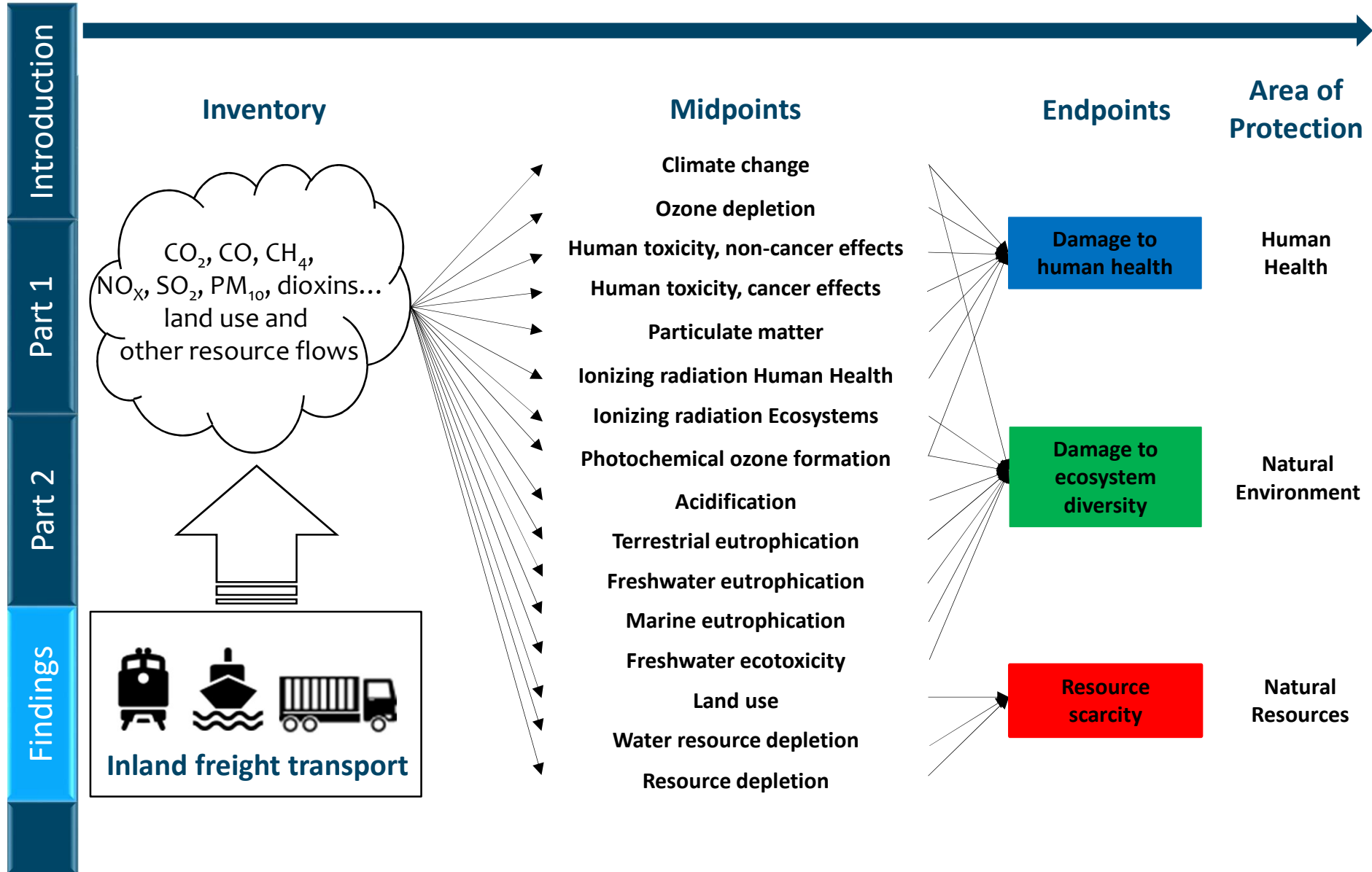
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- Environmental impacts of a product from raw material extraction, through materials use, and finally to disposal





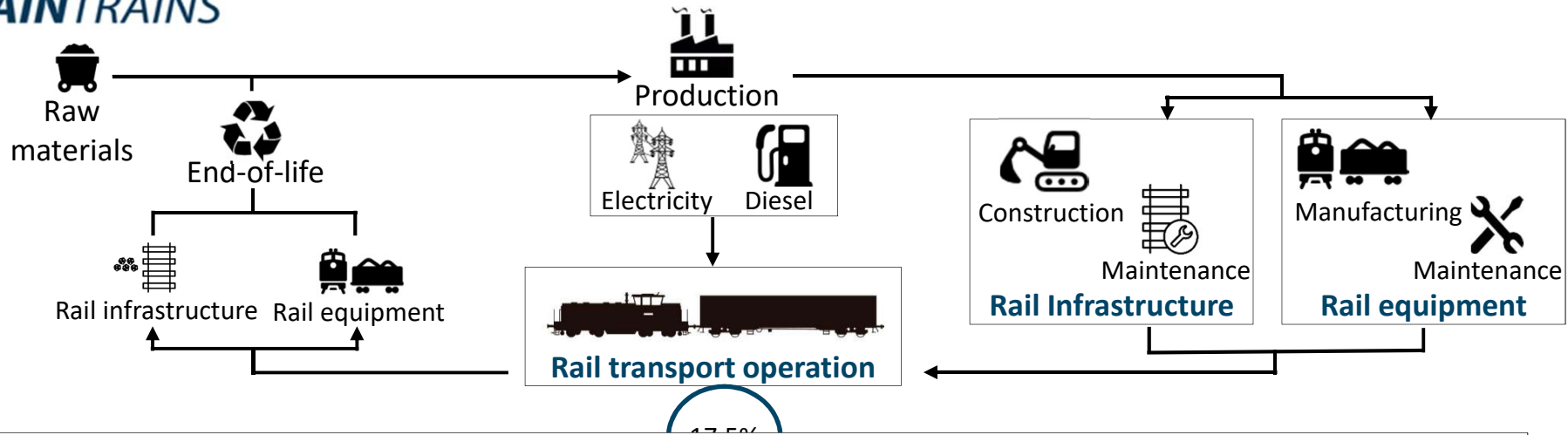
3c: Life Cycle Assessment (2)



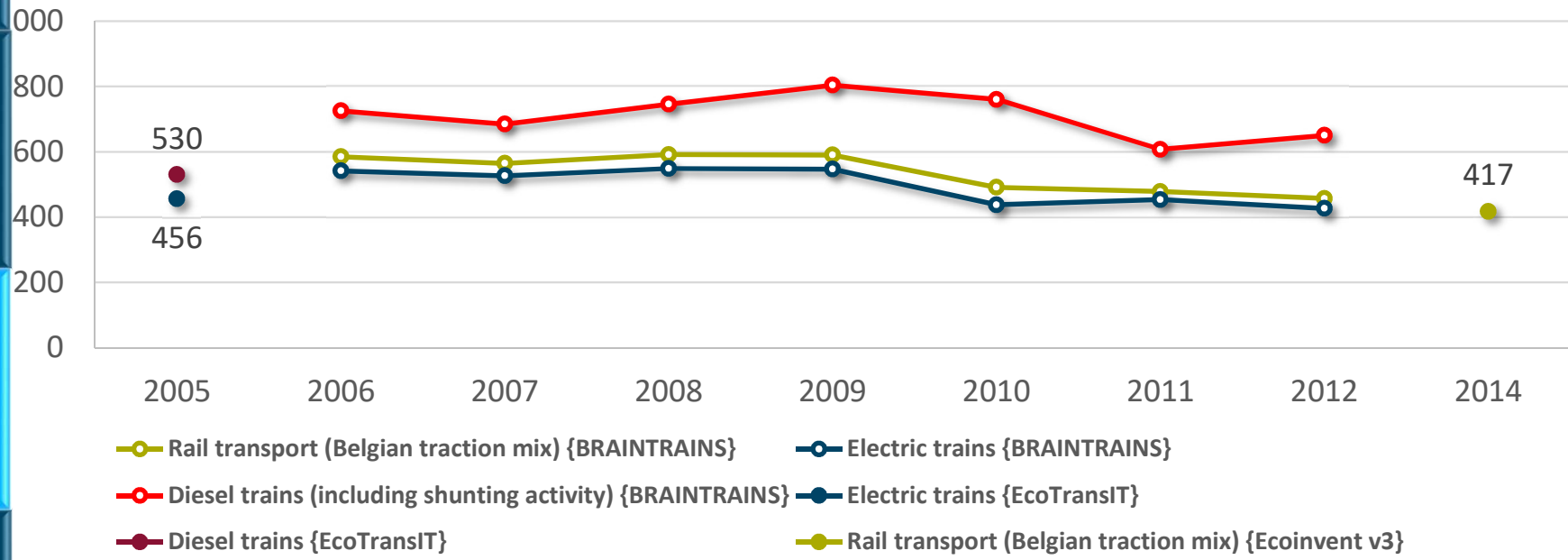


3c: LCA of inland freight transport

Introduction
Part 1
Part 2
Findings



Energy consumption of rail freight transport in Belgium (kJ/tkm)





3c: Conclusion

Introduction

- Intermodal electric rail freight transport represents an opportunity to attain a more environmentally and energy-efficient transport system

Part 1

Part 2

Findings

Impact category	Difference of environmental impact compared to lorry 24-40 t Euro VI	
	Electric train	Diesel train
Climate change	-29%	-9%
Ozone depletion	-36%	-27%
Human Toxicity, non-cancer effects	-1%	+2%
Human Toxicity, cancer effects	+43%	+43%
Particulate matter	-48%	-17%
Ionizing radiation HH	+79%	-6%
Ionizing radiation E (interim)	+43%	-18%
Photochemical ozone formation	-34%	+42%
Acidification	-26%	+37%
Terrestrial eutrophication	-20%	+60%
Freshwater eutrophication	+35%	+20%
Freshwater ecotoxicity	-53%	-52%
Land use	-75%	-65%
Resource depletion	-43%	-40%



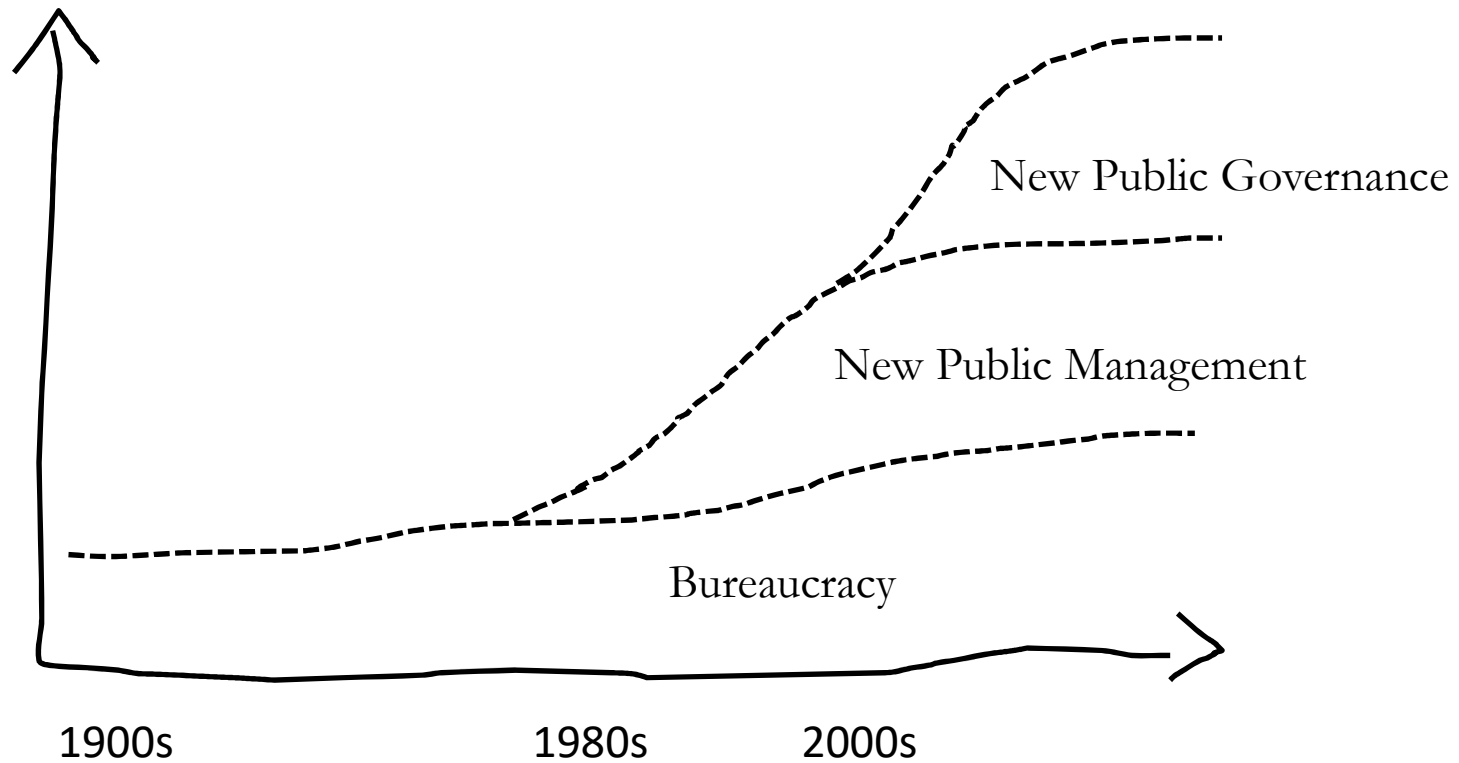
3d: Government organisation: 3 models

Introduction

Part 1

Part 2

Findings





3d: Government organisation: Current levels of policy organisation

Introduction

- Autonomous decision-making between political actors from different levels of government regarding the transposal of the EU ITS-directive.

Part 1

- Minimal policy coherence between federal and regional levels of government to comply to the set targets of the EU-level.

Part 2

- Up till now, there has only been very limited collaborative effort to establish a comprehensive and uniform policy strategy that transcends the different levels of government

Findings



3d: Government organisation: Who should take the lead?

Introduction

Part 1

Part 2

Findings

- At the political-level?
 - A Federal Minister?
 - A regional Minister? From Wallonia, Brussels Capital Region or Flanders?
 - A neutral facilitator?
- At the administrative level?
 - An intergovernmental coordination network?
 - An expert group? A follow-up committee?
 - Separate administrative leaders for each level of government?



3d: Government organisation: Which actors should be involved?

Introduction

- Only the political core?
 - Solely Ministers of Mobility, or also of Ministers of (affected) departments (e.g. economy, finance, environment)?

Part 1

- An administrative network?
 - How many departments and agencies? And when is a department/agency relevant or ‘affected enough’ to join the collaboration?

Part 2

- Stakeholders?
 - How to select ‘the right’ stakeholders?

Findings



3d: Government organisation: Outlook?

Introduction

How 'long-term should the policy strategy be? An outlook to 2020? 2030? 2050? 2100?

- And how to deal with long-term policy strategies when there are new elections?

Part 1

How detailed must the policy strategy be?

- Only output parameters?
- Abstract future outlooks?
- Detailed, and non-reversible, policy strategies.

Part 2

Findings



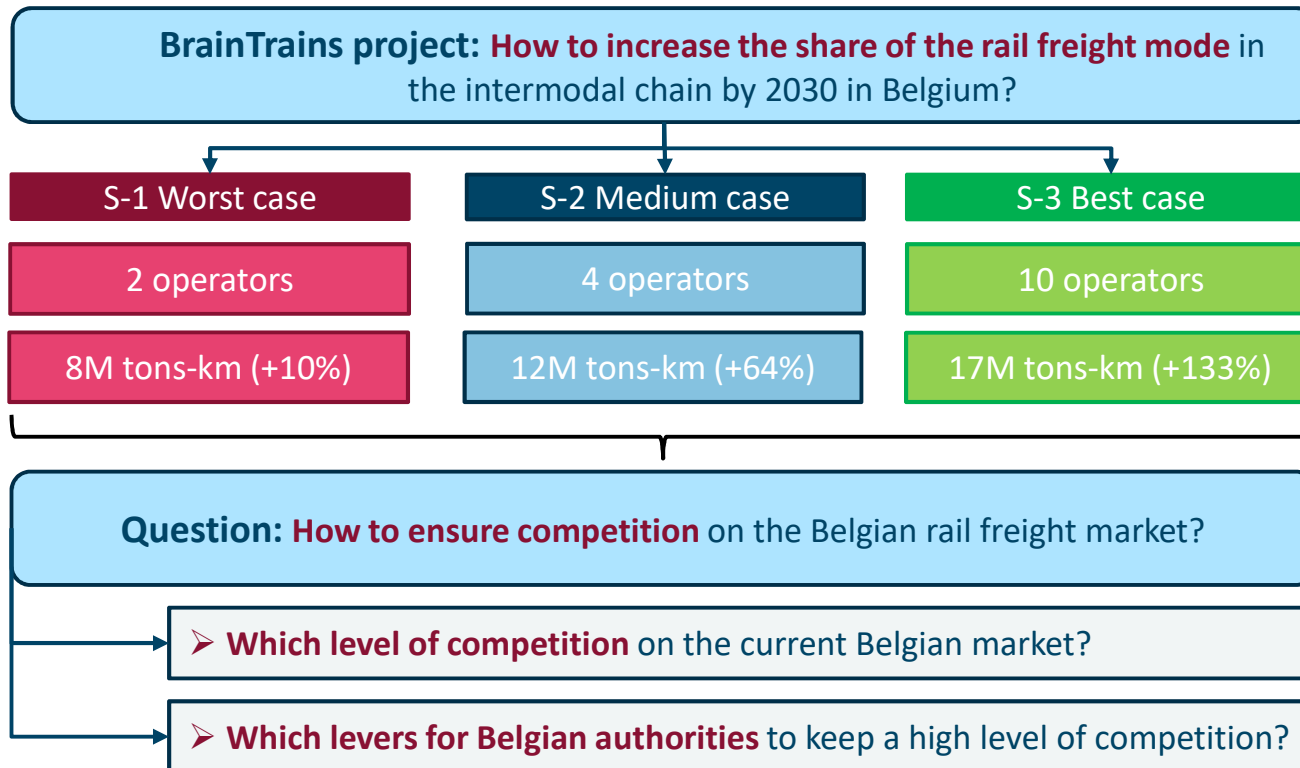
3b: Regulation: The context

Introduction

Part 1

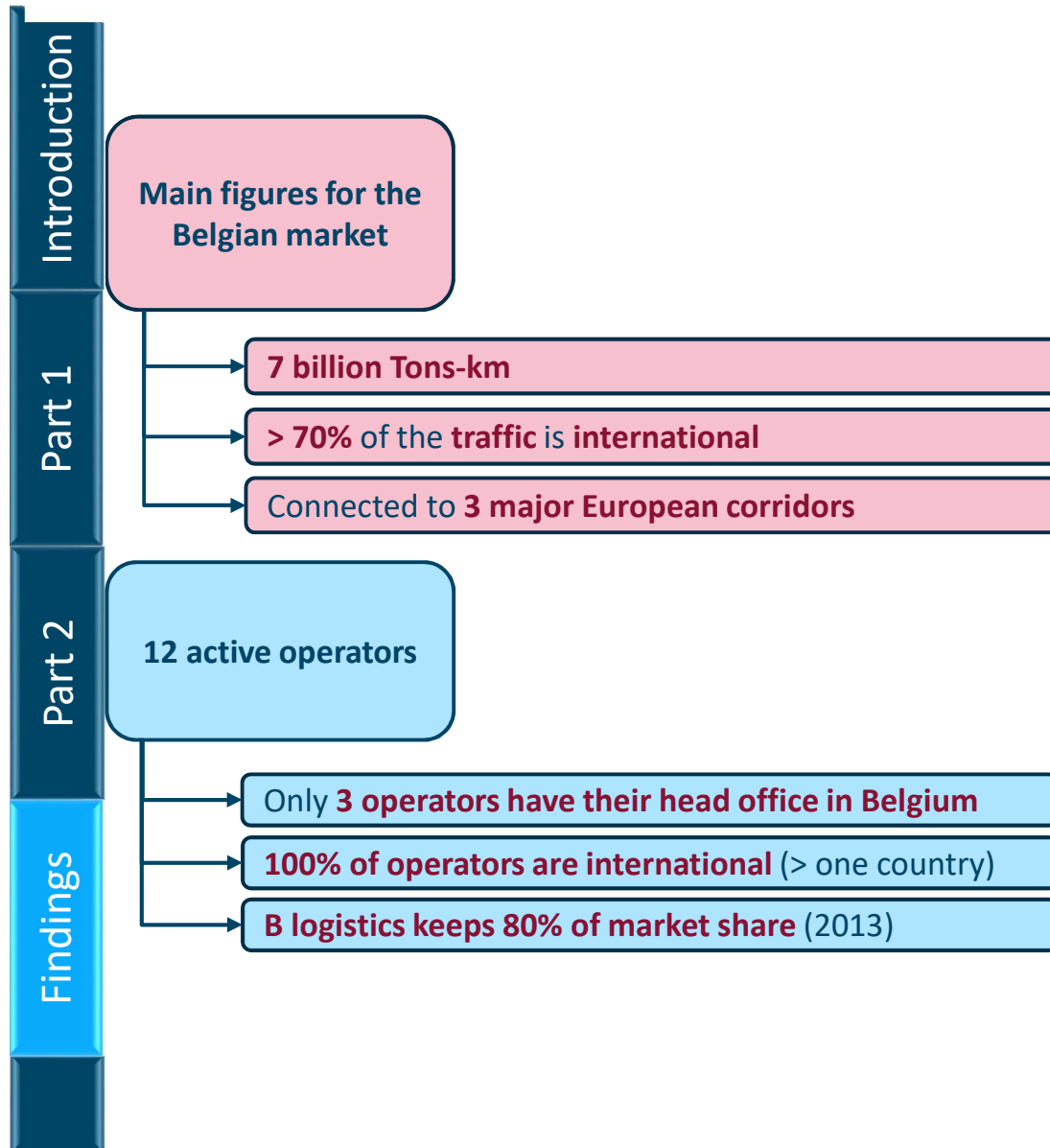
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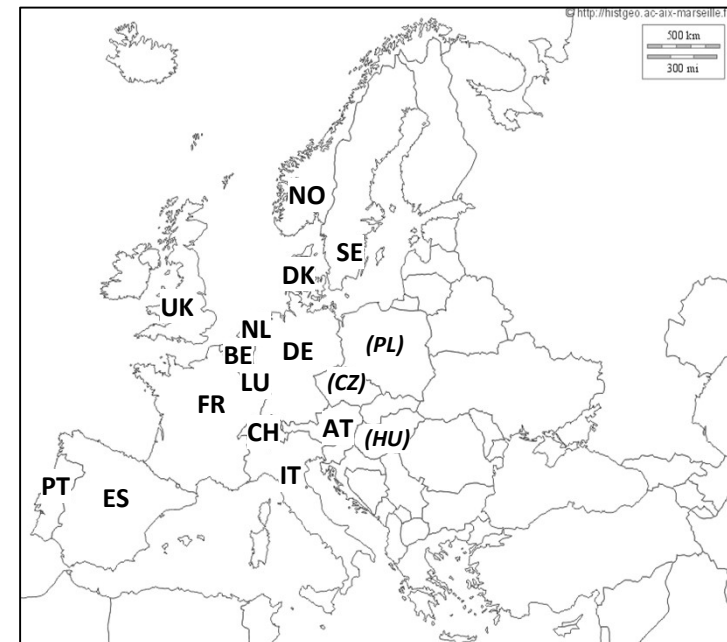




3b: Regulation: Perimeter



Market scope: Western European market



3b: Regulation: Methodology

- Introduction
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Two approaches to assess current competition

Static approach (picture)

Dynamic approach (evolution)

Concentration Ratio (CR4)

$$CR4 = \sum_{i=1}^4 s_i$$

Herfindahl-Hirschman Index (HHI)

$$HHI = \sum_{i=1}^n s_i^2 \times 10,000$$

Number equivalent (NE)

$$NE = 1 / HHI$$

Persistence of a firm's standardized profit rate (POP)
 = firm's profit rate – average profit rate across all firms

$$\pi_{i,t}^s = \pi_{i,t} - \bar{\pi}_t$$

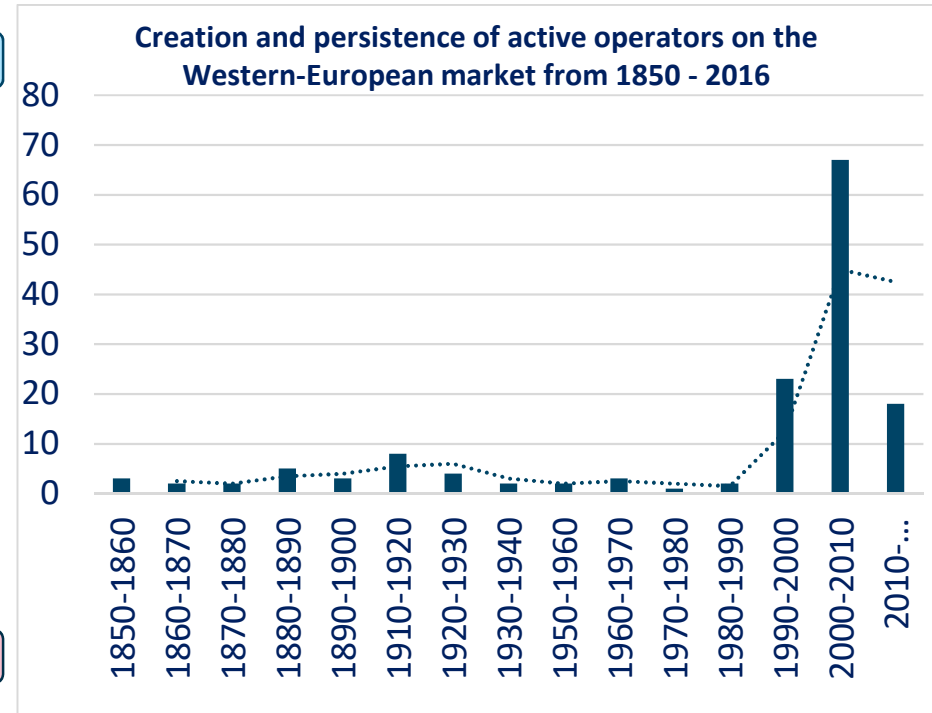
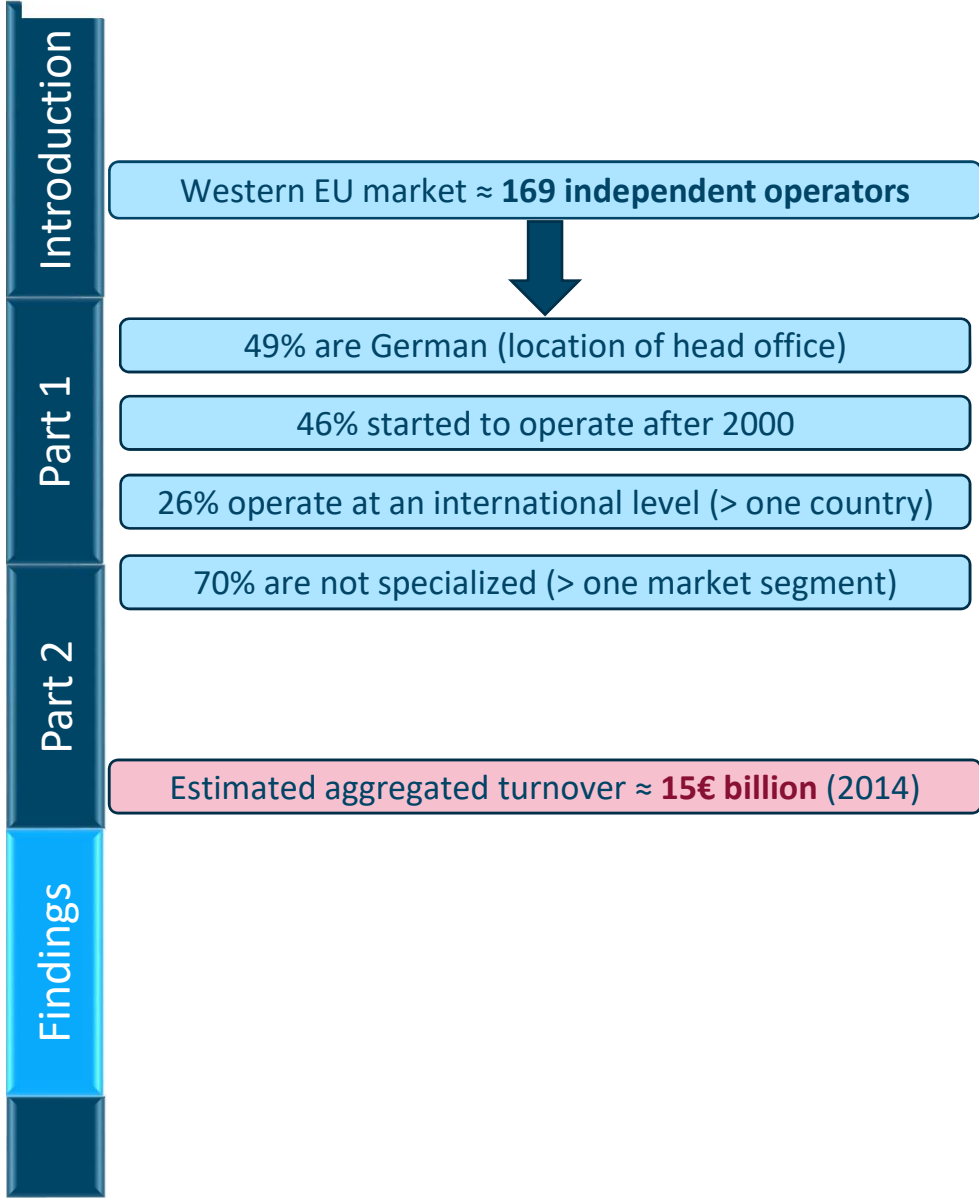
Existence of abnormal profit in short-run (SR) and long-run (LR)?

Persistence on LR: low competition & high barriers

No Persistence on LR: high competition & low barriers



3b: Regulation: Results: static approach



Source: own composition





3b: Regulation: Results: static approach (2)

	Rank	Company	Turnover (€)	Nationality	Creation
Introduction	1	DB Schenker Rail	4.517.000.000	DE	1994
	2	Rail Cargo	2.073.100.000	AU	1923
	3	SNCF Geodis	1.107.000.000	FR	1937
	4	PKP cargo	999.767.000	PL	1918
Part 1	5	SBB Cargo	821.240.009	CH	1902
	6	Geneese&Wyoming	635.928.658	USA	1995
	7	Trenitalia cargo	623.000.000	IT	1905
	8	B logistics	451.860.473	BE	1926
	9	Green cargo	444.266.000	SE	1856
	10	Hupac	392.400.000	CH	1967
Part 2	11	Europorte	267.000.000	FR	2005
	12	RENFE mercancias	259.800.000	ES	1941
	13	CTL Logistics GmbH	177.634.046	PL	2003
	14	CFL Cargo	153.793.792	LU	1946
	15	Cargo Net	147.255.689	NO	1883
	16	Lotos Kolej	141.359.734	PL	2002
Findings	17	BLS Cargo	138.978.758	CH	1941
	18	Verkehrsbetriebe Peine - Salzgitter	115.651.000	DE	1971
	19	LKAB Malmtrafik	112.571.000	SE	1903
	20	Holding Exploris	94.000.000	LU	2014

56% of the market

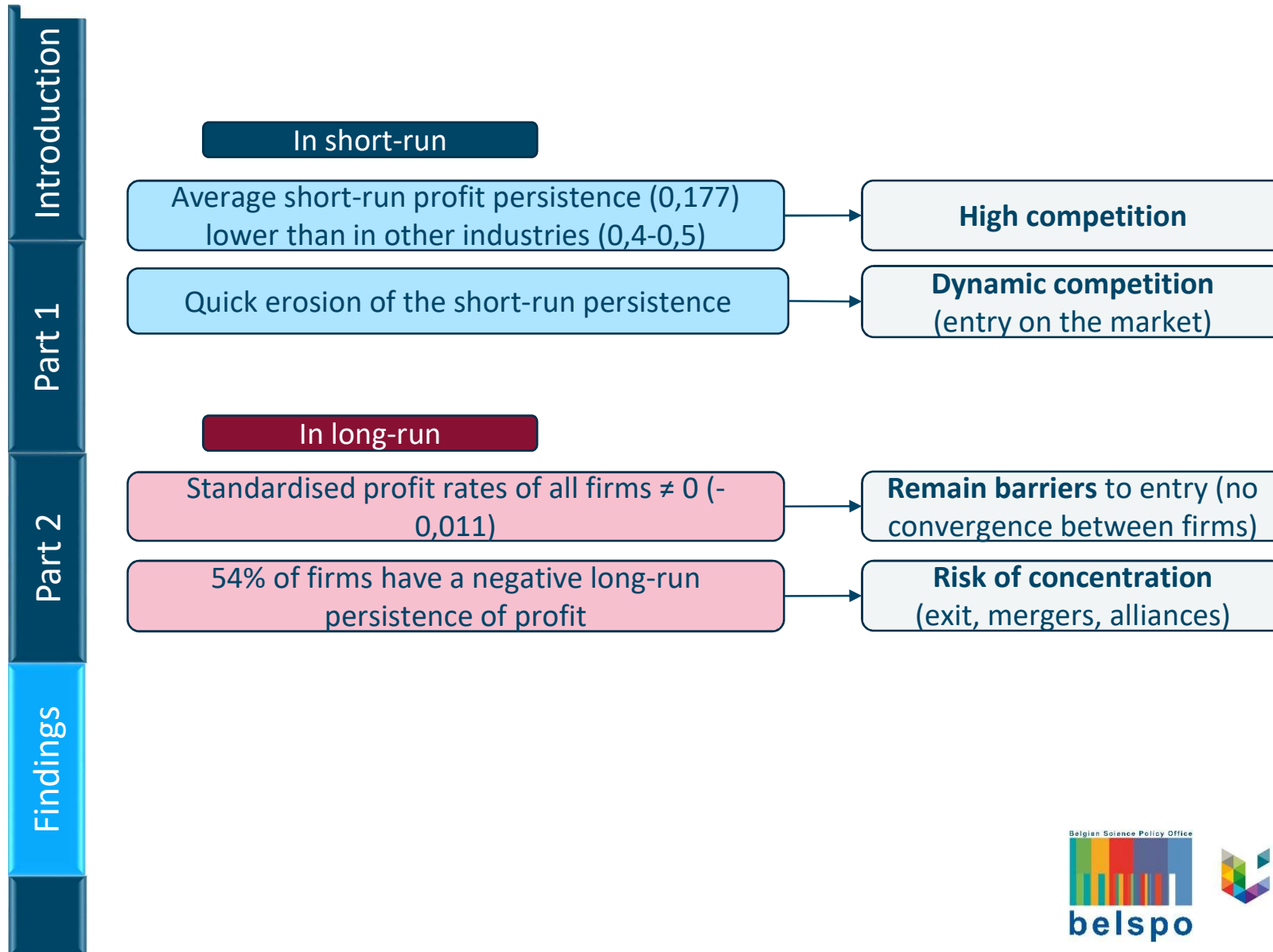
Tight Oligopoly > 60%
Loose oligopoly 25 – 60%
 No oligopoly < 25%

HHI = 1266

Low concentration < 1000
Moderate concentration 1000 – 1800
 High concentration > 1800
 Monopoly 10 000



3b: Regulation: Results: dynamic approach

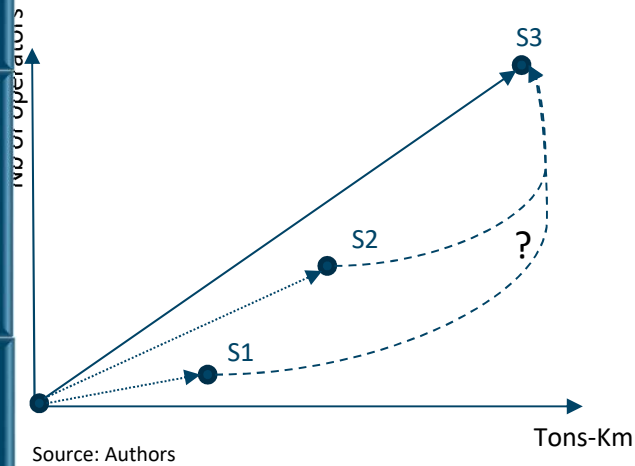




3b: Regulation: How to regulate?

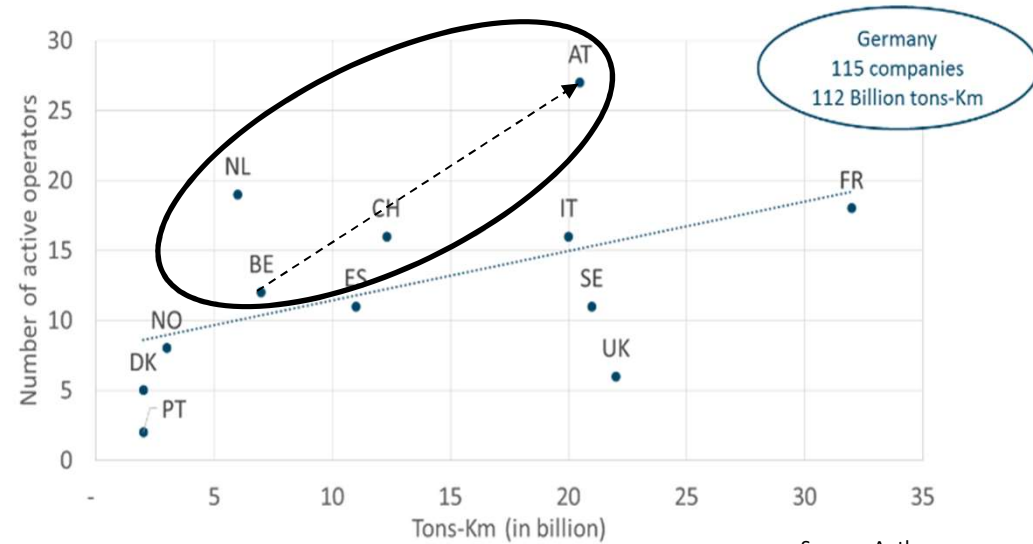
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How to reach the best scenario?



Source: Authors

Link between number of active operators and market size (ton-kms) in 2014



Source: Authors

Benchmark according to

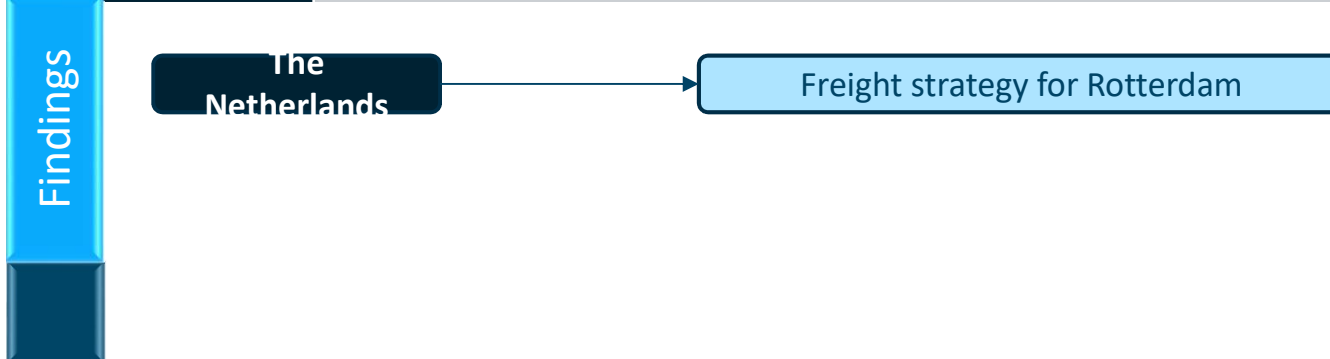
- Transport policy (strategic targets)
- Contract of performance (operational targets)
- Network statement (pricing)
- Regulatory body (skills)





3b: Regulation: The Netherlands

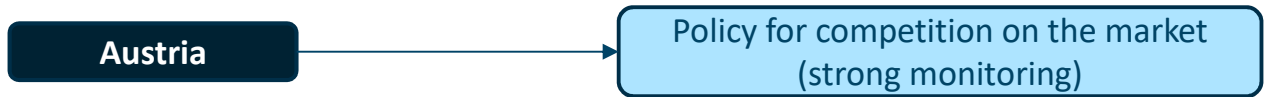
Introduction	LEVER	MAIN FACTS
	General facts	<ul style="list-style-type: none"> ➤ Rail freight modal share: 3% (2000) – 5% (2013) ➤ Rail freight traffic (ton-kms): 4,5 billion – 6.1 billion (2013)
Part 1	Performance contract	<ul style="list-style-type: none"> ➤ Every 10 years, current contract: 2015-2025 with yearly monitoring and deep evaluation of indicators and objectives at mid-term (2019). ➤ 11 indicators with quantitative objectives and penalties, including 2 for freight (user satisfaction and punctuality).
	Transport policy	<ul style="list-style-type: none"> ➤ National strategy for rail freight (2014) ➤ Main objectives: reduce CO₂ emissions and operating costs to increase market attractiveness. ➤ Rail policy supported by a financial fund of €2.4 billion (migration towards ERTMS, STS program to improve the daily resilience, the high-frequency program to increase the traffic, a third track towards Germany from the Betuwe route in 2022).
Part 2	Network statement	<ul style="list-style-type: none"> ➤ Two types of modulation for rail freight: <ul style="list-style-type: none"> ➤ Price for access charges more attractive on the Betuwe route than the classic network (-24%); ➤ Advantage for access charges above 600 tons.
	Regulatory body	<ul style="list-style-type: none"> ➤ Not specialized in rail ➤ No restrictive control on the network statement





3b: Regulation: Austria

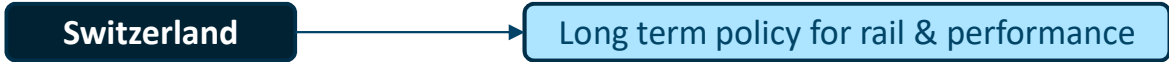
	LEVER	MAIN FACTS
Introduction	General facts	<ul style="list-style-type: none"> ➤ Rail freight modal share: 27% (2000) – 36% (2013) ➤ Rail freight traffic (ton-kms): 16,6 billion – 19,3 billion (2013)
	Performance contract	<ul style="list-style-type: none"> ➤ Every 5 years, current contract: 2016-2021 with yearly monitoring. ➤ Indicators to control the implementation of the transport policy (progress of works, congestion, punctuality). ➤ Incentive scheme: financial penalties in case of non-achievement.
Part 1	Transport policy	<ul style="list-style-type: none"> ➤ National transport strategy (freight and passengers) between 2012 and 2025 ➤ Objectives for freight: + 42% in ton-kms for freight by 2025 and + 30% of capacity on the network. ➤ Actions: Yearly investment of €2 billion, reduction of bottlenecks, infrastructure modernization (ERTMS). ➤ Other: policy of subsidies for the rail freight market (single wagon, non-accompanied vehicle and rolling roads, ERTMS).
	Network statement	<ul style="list-style-type: none"> ➤ Special penalties for freight upper 60 minutes of delay. ➤ Special discount for locomotives equipped with ERTMS on the equipped lines.
Part 2	Regulatory body	<p>Observatory of competition:</p> <ul style="list-style-type: none"> - Analysis of the economic conditions. - Analysis of traffic and market share of new operators (per company). - Analysis of partnerships and mergers between national companies and foreigners. - Annual survey to know the market about network access, business factors, transport policy, technical standards,...
	Findings	





3b: Regulation: Switzerland

	LEVER	MAIN FACTS
Introduction	General facts	<ul style="list-style-type: none"> ➤ Rail freight modal share: 52% (2000) – 47% (2013) ➤ Rail freight traffic (ton-kms): 11.1 billion – 11.8 billion (2013)
	Performance contract	<ul style="list-style-type: none"> ➤ Every 3 years, current contract: 2017-2020 with yearly monitoring. ➤ Main indicators: Safety (number of collisions), availability of the infrastructure (number of slot cancelled), Productivity, etc.
Part 1	Transport policy	<ul style="list-style-type: none"> ➤ National program to develop the rail infrastructure by 2030 (PRODES): +70% of freight traffics ➤ Massive infrastructure investments since 1986 (Rail 2000) ➤ Taxes for road since 2001 (RPLP) according to the distance and the CO₂ emissions; ➤ Investment to reduce noise from rolling stock. ➤ Plan for migration towards ERTMS.
	Network statement	<ul style="list-style-type: none"> ➤ Evaluation every three months of pricing for access charges according to the market and costs. ➤ Pricing modulation (incentives) for: <ul style="list-style-type: none"> - Locomotives with a good environmental performance. - Locomotives equipped with ERTMS. - Rolling stock equipped to reduce the noise.
Part 2	Regulatory body	<ul style="list-style-type: none"> ➤ Independent Commission (CACF) to control the non-discrimination on the network mainly for pricing and access. ➤ Part of the Federal Office for Transport (OFT) which assumes the biggest part of the economic regulation
	Findings	

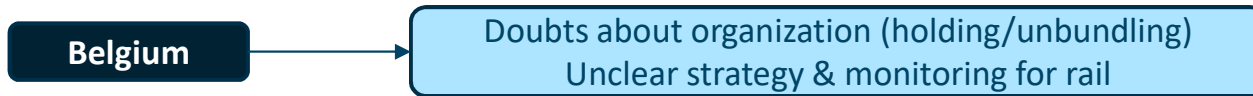




3b: Regulation: Belgium

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LEVER	MAIN FACTS
General facts	<ul style="list-style-type: none"> ➤ Rail freight modal share: 11%– 14% (2013) ➤ Rail freight traffic (ton-kms): 7,7 billion (2000) – 6.5 billion (2013)
Performance contract	<ul style="list-style-type: none"> ➤ Every 4 years, last period: 2008 – 2012 ➤ Objective for freight: +35% tons-km between 2006-2012 ➤ One indicator with incentive for passenger (max number of minutes for delay) ➤ No indicator with incentive for freight
Transport policy	<ul style="list-style-type: none"> ➤ Port connectivity: Antwerp & Zeebruges ➤ Safety and interoperability: full migration towards ERTMS in 2025 ➤ Modernization of the network: reduction from 350 traffic centers in 2005 to 31 in 2017
Network statement	<ul style="list-style-type: none"> ➤ No advantage to the rail freight for access charges
Regulatory body	<ul style="list-style-type: none"> ➤ No restrictive control on network statement ➤ Limited control on the rail freight market because of the large share of international traffic

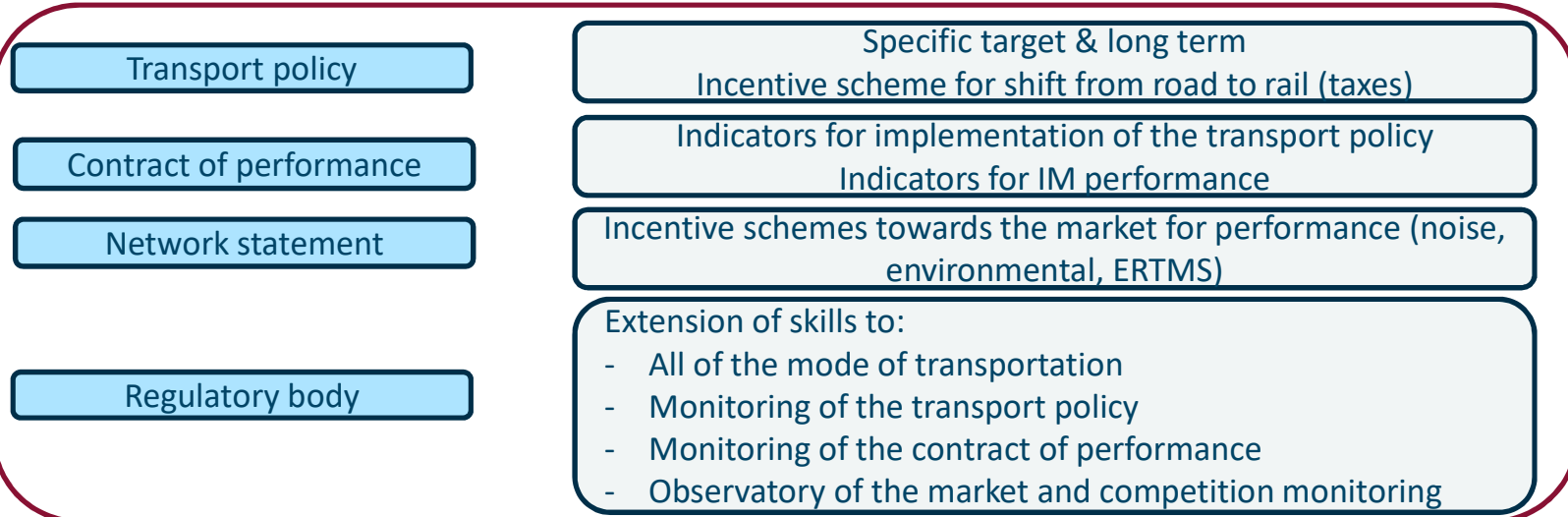




3b: Regulation: Policy paths

- Introduction
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Reach the best target under low concentration in Belgium (scenario 3)



Reach the best target under high concentration in Belgium (scenario 1)

