Technical Innovation Circle for Rail Freight Transport (TIS)

Task Force Earnings-Adjusted / Basic LCC Model

Conceptual framework for a standard earnings-adjusted / basic LCC model

Karlsruhe | 31 March 2014

A | Formulation of a conceptual framework for an earnings-adjusted / basic LCC model

B | Development of a basic LCC model for innovative bogies

I) TIS distinguishes between an earnings-adjusted model and a basic LCC model.

Earnings-adjusted / Basic LCC model

Earnings-adjusted model

- Captures both life cycle costs (LCC) **and** earnings

- Designed to evaluate the profitability of **freight wagons** over their economic lifetime
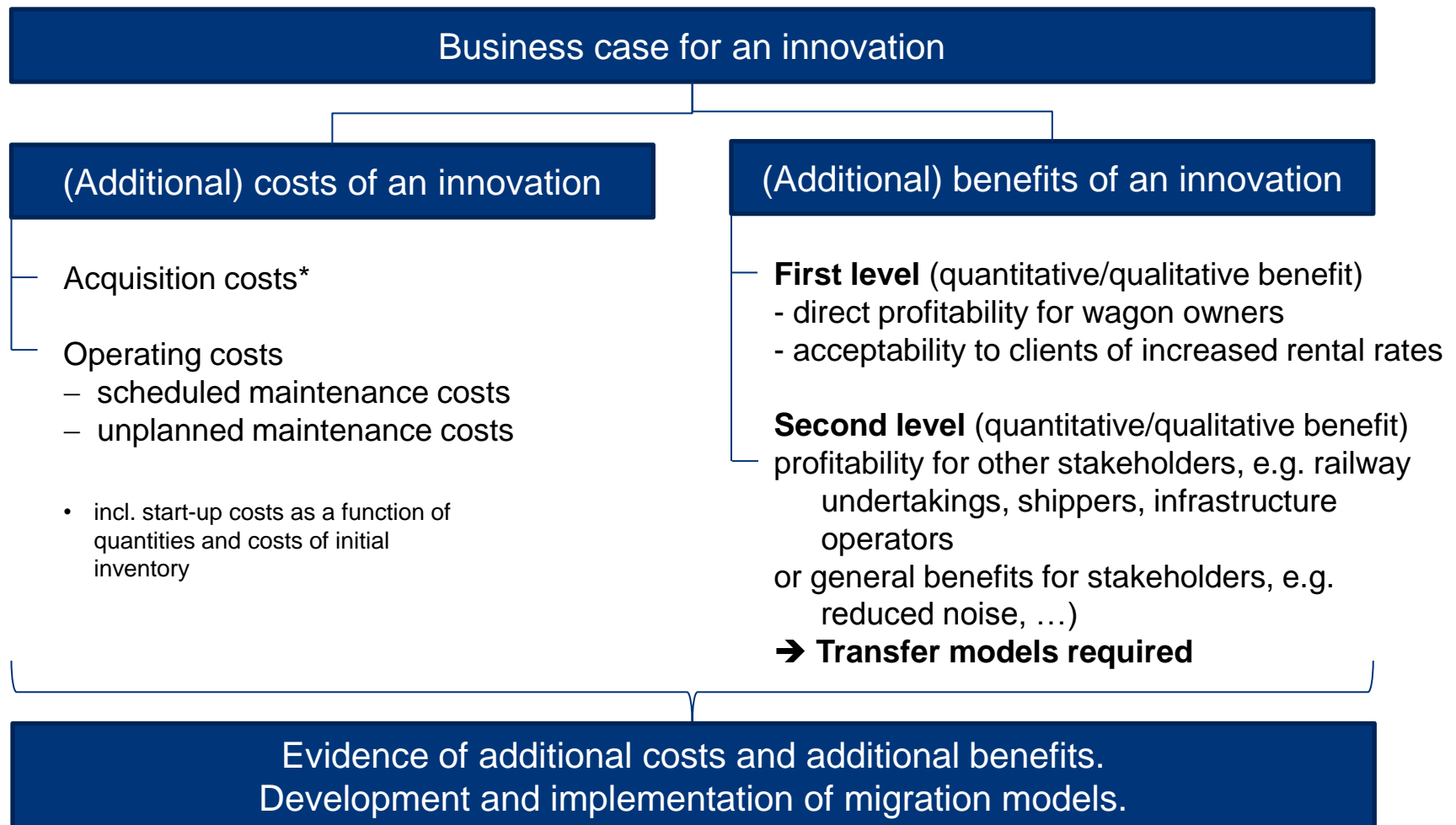
Basic LCC model

- Captures life cycle costs (LCC) only

- Designed to evaluate the cost situation of **systems** (e.g. bogie) and **modules** (e.g. wheelset) and to permit comparison with innovative systems / modules

- Combined with the earnings-adjusted model when differences significantly impact earnings
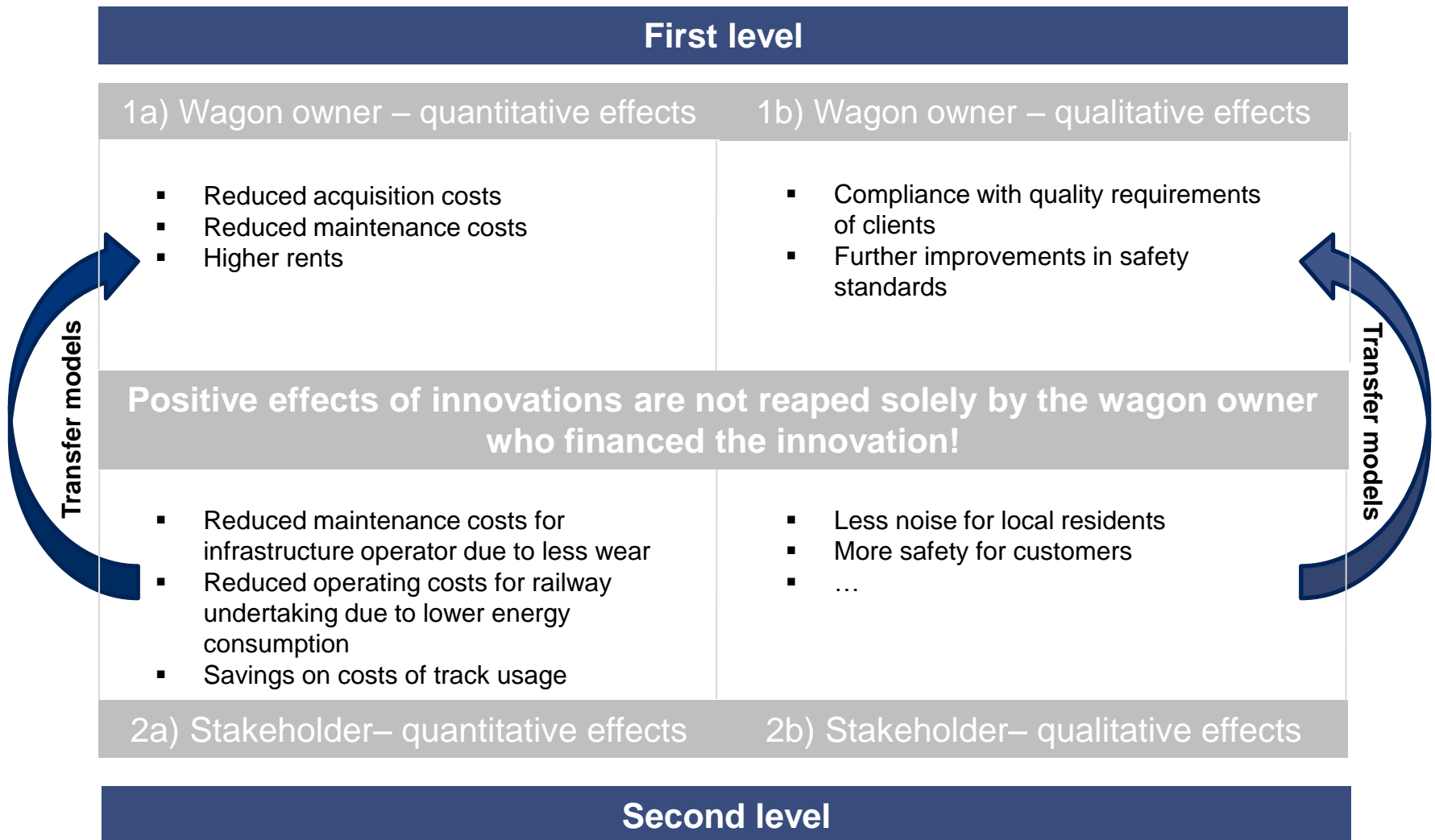
Quantity structure for future acquisitions of freight wagons/systems/modules
Between 7,000 and 15,000 freight wagons are built in Europe every year.
In some cases derived from realistic system/module-specific quantity structures.

II) The business case for an innovation derives from a comparison of additional benefits and additional costs.

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Business case for an innovation

(Additional) costs of an innovation

Acquisition costs*

Operating costs
- scheduled maintenance costs
- unplanned maintenance costs

• incl. start-up costs as a function of quantities and costs of initial inventory

(Additional) benefits of an innovation

First level (quantitative/qualitative benefit)
- direct profitability for wagon owners
- acceptability to clients of increased rental rates

Second level (quantitative/qualitative benefit)
profitability for other stakeholders, e.g. railway undertakings, shippers, infrastructure operators
or general benefits for stakeholders, e.g. reduced noise, …)
➔ **Transfer models required**

Evidence of additional costs and additional benefits.
Development and implementation of migration models.

III) The benefit of an innovation can be shared among various stakeholders – Need for transfer models

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First level

1a) Wagon owner – quantitative effects

- Reduced acquisition costs
- Reduced maintenance costs
- Higher rents

1b) Wagon owner – qualitative effects

- Compliance with quality requirements of clients
- Further improvements in safety standards

Positive effects of innovations are not reaped solely by the wagon owner who financed the innovation!

- Reduced maintenance costs for infrastructure operator due to less wear
- Reduced operating costs for railway undertaking due to lower energy consumption
- Savings on costs of track usage

- Less noise for local residents
- More safety for customers
- …

2a) Stakeholder– quantitative effects

2b) Stakeholder– qualitative effects

Second level

Transfer models

Transfer models

IV) Objectives of the earnings-adjusted / basic LCC model

1 Development of an earnings-adjusted / basic LCC model, agreed across the sector, founded on real or plausibly derived rates
➔ **Target: Rail freight sector**

2 Decision-making tool for wagon owners seeking to invest in innovative freight cars / systems / modules ➔ **Target: Profitability for wagon owners**

3 Indication to manufacturers of target costs for the development of innovative freight cars / systems / modules ➔ **Target: Wagon manufacturers**

4 Definition and visualisation of benefits to various rail freight stakeholders of innovative freight cars / systems / modules ➔ **Target: Profitable rail freight transportation**

5 Findings from the earnings-adjusted / basic LCC model serve as a basis for developing transfer of benefit models (incentive system) if the benefit is not reaped by wagon owners ➔ **Target: Profitability for wagon owners**
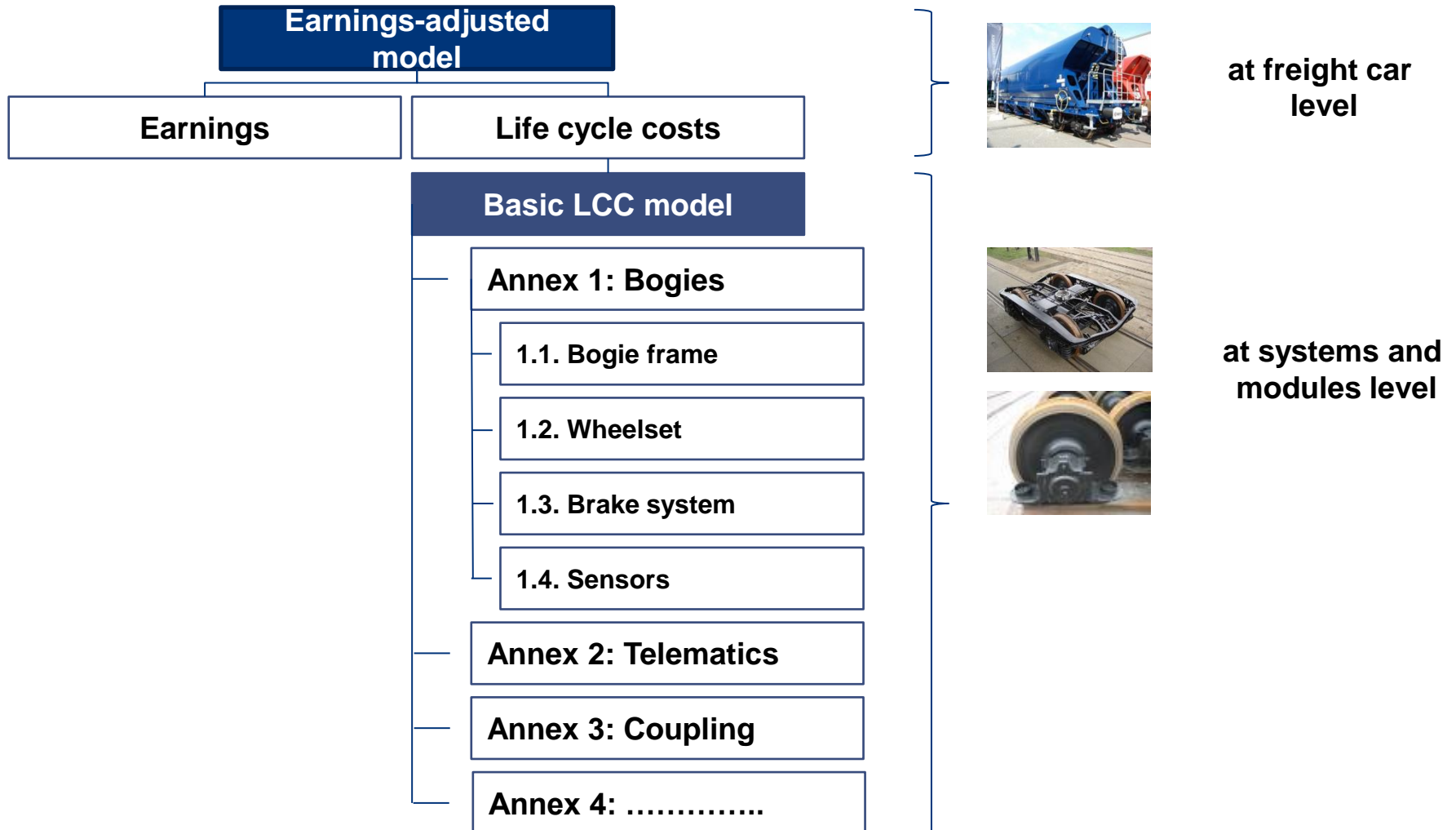
6 Formulation of migration scenarios for innovative freight cars / systems / modules based on findings from the earnings-adjusted / basic LCC model and the transfer model
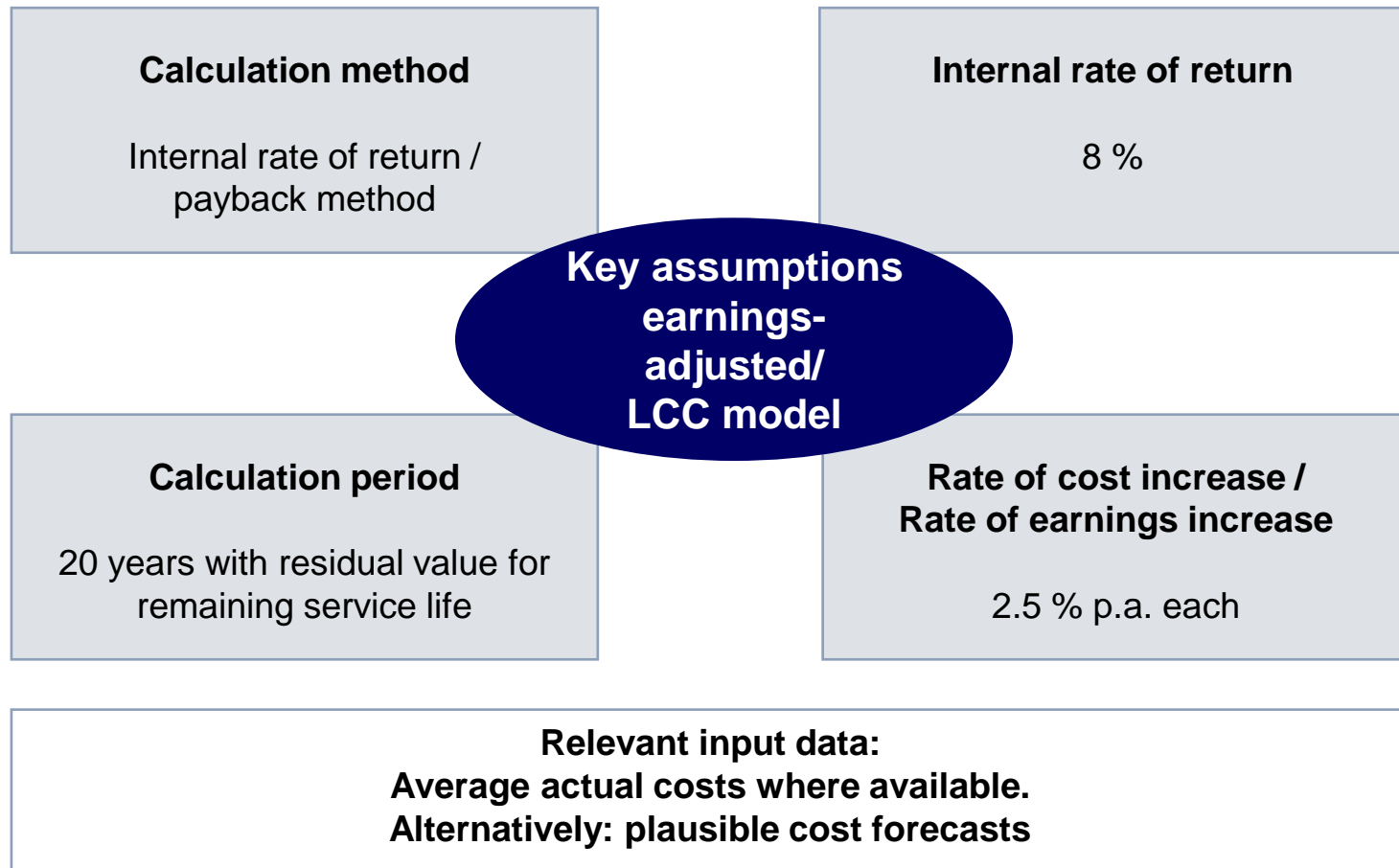➔ **Target: Implementation of innovations to strengthen the rail freight business**

7 Identification of funding agenda or need for seed funding for innovative freight cars / systems / modules ➔ **Target: Political community**

Earnings-adjusted model

Earnings

Life cycle costs

at freight car level

Basic LCC model

Annex 1: Bogies

1.1. Bogie frame

1.2. Wheelset

1.3. Brake system

1.4. Sensors

Annex 2: Telematics

Annex 3: Coupling

Annex 4: …………..

at systems and modules level

VI) Key input parameters for earnings-adjusted / LCC models

Calculation method

Internal rate of return / payback method

Internal rate of return

8 %

Key assumptions earnings-adjusted/ LCC model

Calculation period

20 years with residual value for remaining service life

Rate of cost increase / Rate of earnings increase

2.5 % p.a. each

Relevant input data:
Average actual costs where available.
Alternatively: plausible cost forecasts

A **Formulation of a conceptual framework for an earnings-adjusted / basic LCC model**

B **Development of a basic LCC model for innovative bogies**

Development of a basic LCC model for innovative bogies

Life cycle costs

System   Y25 bogie   v.   Innovative bogie

Module

Bogie frame	Wheelset	Brake system*	Sensors
— Frame	— Axle	— Axle-mounted disc brake	Results of LCC calculations taken on board by the task force on Telematics / Sensor Technology
— Sockets	— Discs	— Conventional composite pad brake (bilateral action)	
— Suspension	— Bearing/Box	— Conventional composite pad brake (unilateral action)	
		— Compact brake (unilateral action)	
		— Cast iron brake (bilateral action)	

* incl. brake pads and brake lever connectors, costs are calculated per bogie

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The following definition applies to the components of the "Brake system" module:
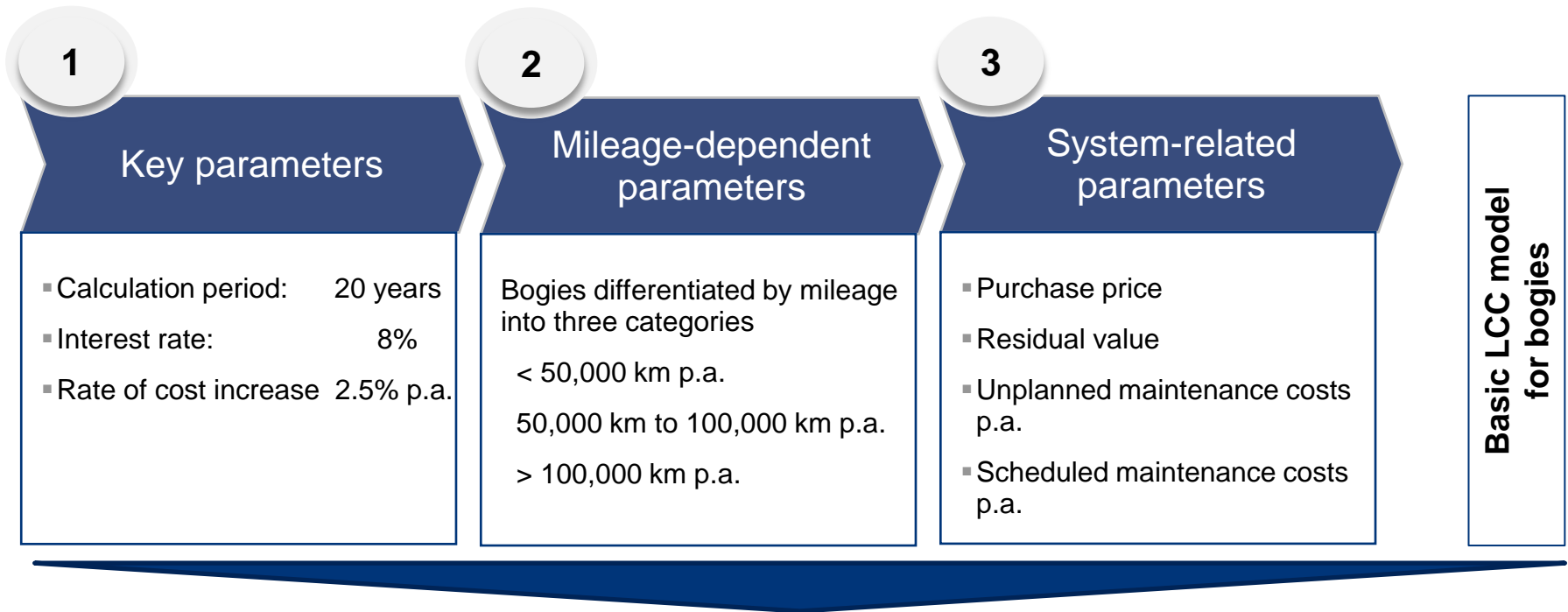
Conventional brake

— Braking system
(incl. controls and air tank)

— Rigging and pad holders

— Hand brake connection

— Brake pads

Axle-mounted disc brake

— Braking system
(incl. controls and air tank)

— Calliper unit

— Disc mounting

— Hand brake connection (flexball)

— Linings

Annex 1:
Input parameters for the basic LCC model "Innovative bogies"

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1

Key parameters

- Calculation period: 20 years
- Interest rate: 8%
- Rate of cost increase 2.5% p.a.

2

Mileage-dependent parameters

Bogies differentiated by mileage into three categories

< 50,000 km p.a.

50,000 km to 100,000 km p.a.

> 100,000 km p.a.

3

System-related parameters

- Purchase price
- Residual value
- Unplanned maintenance costs p.a.
- Scheduled maintenance costs p.a.

Basic LCC model for bogies

- The focus is initially on capturing direct effects on the wagon owner (1st level). Only then does it shift to capturing 2nd-level effects (railway undertaking, rail infrastructure undertaking, …).

- Use is made of costs known to TIS participants and informed determination of costs for new, innovative systems / modules.

- When company-specific costs diverge widely, agreement is reached about realistic assumptions.