



## White Paper The Intelligent Freight Train

From the innovative freight wagon  
to the intelligent freight train

The TIS roadmap for  
competitive rail freight

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Digitisation and automation strategies must take account of the entire train. Only this approach can pave the way for a competitive rail freight sector.

# Technical Innovation Circle for Rail Freight Transport (TIS)

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# 14 committed member companies from the rail freight sector are engaged in TIS

BASF SE



DB Cargo AG  
DB Systemtechnik GmbH



ELH Waggonbau Niesky GmbH



Ermewa SA



GATX Rail Germany GmbH



GATX Rail Europe

Knorr-Bremse Systeme für  
Schienenfahrzeuge GmbH



**KNORR-BREMSE**

Rail Cargo Austria AG



SBB Cargo AG



VTG AG



J.M. Voith SE&Co.KG



Wabtec Europe



Waggonbau Graaff GmbH



## Scientific Board

Wascosa AG



Technische Universität  
Dresden



**TECHNISCHE  
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DRESDEN**

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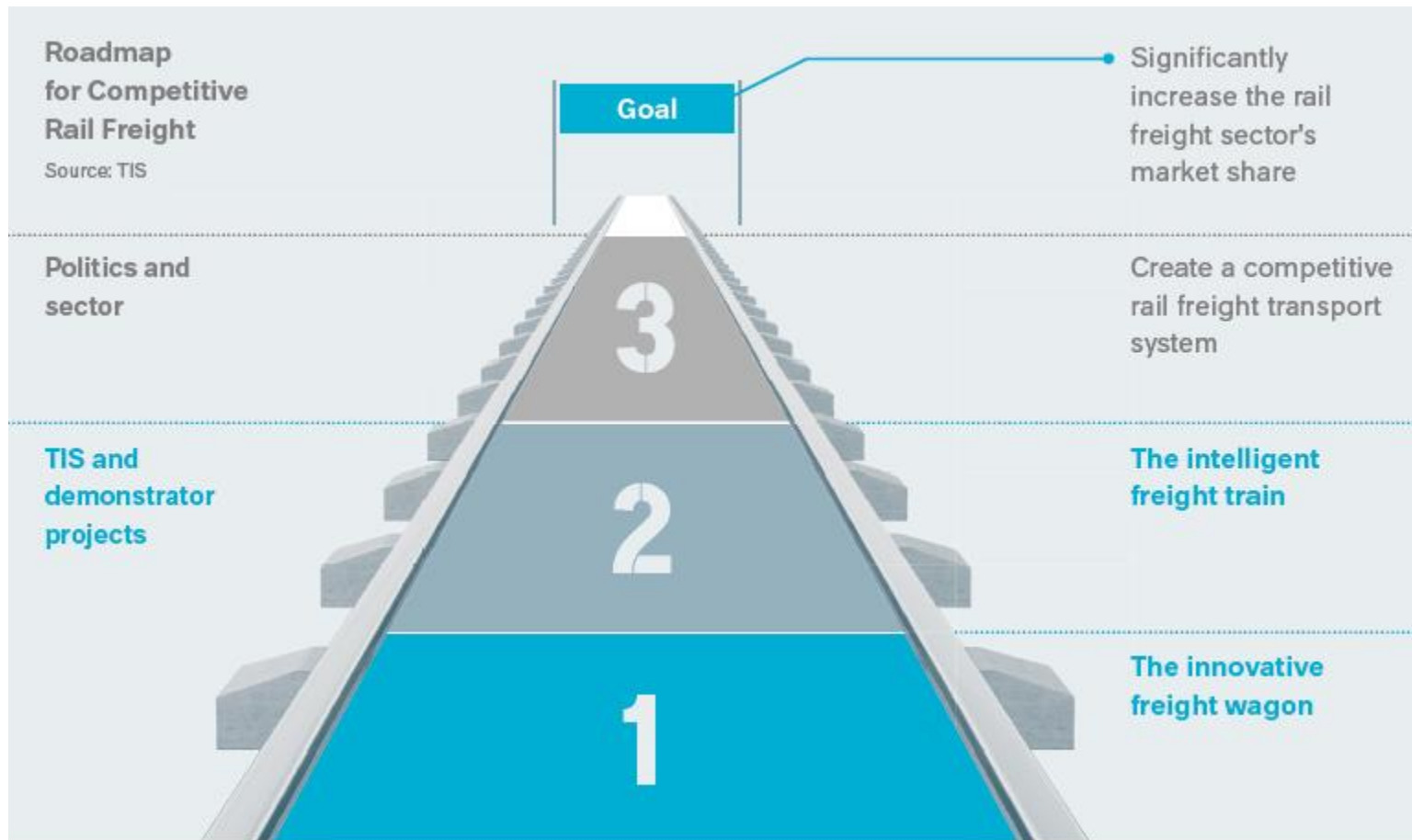


## Project Office



Gesellschaft für Transport- und Unternehmensberatung mbH

# The TIS roadmap for the future of rail freight



TIS-White Book „Intelligent Freight Train“ – download [www.tis.ag](http://www.tis.ag)

The success of any innovation must be judged by whether it increases the productivity of rail freight transport. The TIS concept of the “innovative freight wagon” will guide the sector towards marketable solutions.






## Innovative Freight Wagon



# In 2012 the TIS-White Paper „Innovative Freight Wagon 2030“ has been published

The TIS White Paper 2012 served as the starting signal for the „**5L-Future Initiative**“

## „5L“-criteria

	<b>Logistics-capable</b> Integration into supply chains; high level of operability
	<b>Lightweight</b> Higher load volume due to lower wagon tare weight
	<b>Life-cycle-cost-based</b> Ensuring the profitability of an investment over the life cycle
	<b>Low-noise</b> Significant reduction of rail freight wagon noise emissions
	<b>Lasting the Course</b> Reduction of downtimes and stynby times, icrease in annual mileage





# Four TIS key topics for innovative freight wagons

## TIS key themes for innovative freight wagons

Source: TIS

### 1. Telematics and sensors

Standardisation of interfaces for the exchange of telematics data:

- Server-server interface (Interface 1)
- Telematics unit sensor (Interface 2)
- Telematics unit/hand-held sensor (Interface 3)
- In-train communication (Interface 4)

### 2. Innovative running gear

- Innovative bogies
- Innovative disc brakes
- Innovative wheelsets

### 3. Innovative wagon design

- Lightweight design
- Innovative superstructures / modular container concepts

### 4. Cost-efficiency / LCC

- LCC models for freight wagon components – for analysing the cost-effectiveness of innovations in comparison to standard components
- Income approach model for freight wagons

# Projects on innovative freight wagons have been carried out by TIS members

„5L“ demonstrator train  
from SBB Cargo



## „5L“-demonstrator train from SBB Cargo

- Innovative bogies, wheelsets and disc brakes
- Telematic applications
- Automatic couplings
- Container concept

Innovative freight wagon  
from DB Cargo AG and  
VTG AG



## BMVI-project „Innovative freight wagon“ - DB Cargo and VTG

- Four innovative freight wagon types
- Innovative bogies, disc brakes, wheelsets
- Telematic/sensors, digital brake monitoring systems
- Power and data cables, ep-brakes, automatic coupling

Innovative tank container  
concept from BASF SE



## Innovative tank container concept from BASF

- Innovative container wagon (light weight)
- Innovative, large tank container
- Automated tank container storage
- Automated Guided Vehicles (AGV)

Source photos: SBB Cargo, DB Cargo/VTG, BASF



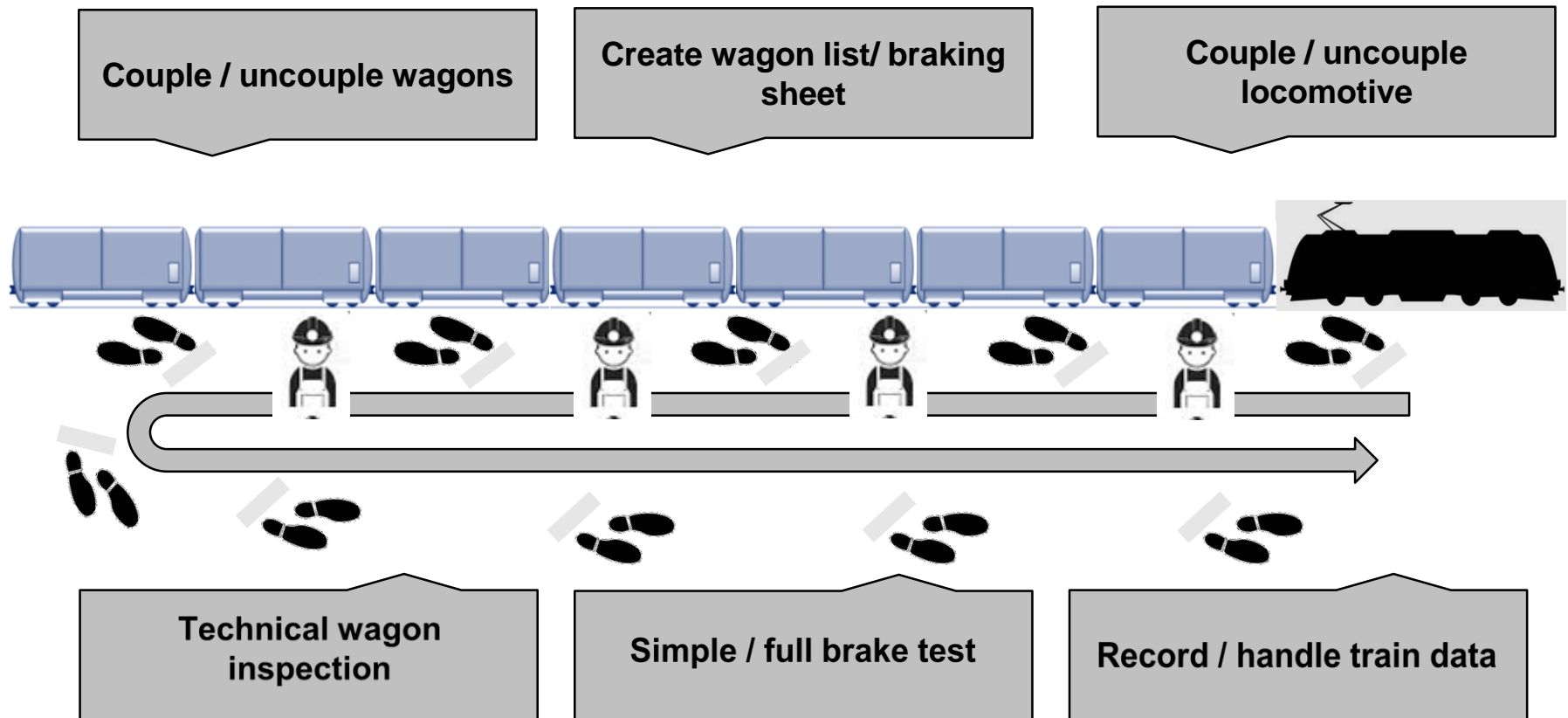
The intelligent freight train  
puts efficiency back on track.  
The heart of the system:  
the digital automatic coupling  
with continuous power and  
data lines.

# Intelligent Freight Train



# Today a lot of manual work has to be done in order to operate freight trains

## Exemplary activities for manual operations before train departure



\* In single wagon traffic, especially in train formation systems, the manual tasks are much more extensive than shown above.

# Even for operating blocktrains and intermodal trains a lot of manual efforts have to be done

<div>Manual operations</div> <div>Traffic</div>	Coupling loco	De-coupling loco	Coupling wagon	De-coupling wagon	Handle train data	Record train data	Create/print wagon list	Technical wagon inspection	Brake test (simple/full)
Block train automotive Roundtrip	29x		13x		3x	3x	3x	3x	5x
Block train bulk Roundtrip	14x	12x	7x	7x	6x	6x	3x	3x	6x
Intermodal train – maritime Roundtrip	8x	8x	30x	30x	4x	4x	4x	4x	9x
Intermodal train – continental Roundtrip	8x	8x	-	-	2x	2x	2x	2x	7x
Block train iron ore Roundtrip	12x	10x	6x	6x	2x	2x	2x	2x	4x
Block train steel Roundtrip	22x	22x	12x	12x	2x	2x	2x	2x	23x

Source: hwh; process analysis rail freight transportation

# In order to reduce manual effort TIS follows on four major innovation topics for intelligent freight trains

## Intelligent freight train

### 1. Automated train operations



### 2. Digital automatic coupling (DAC)



### 3. Energy and data management

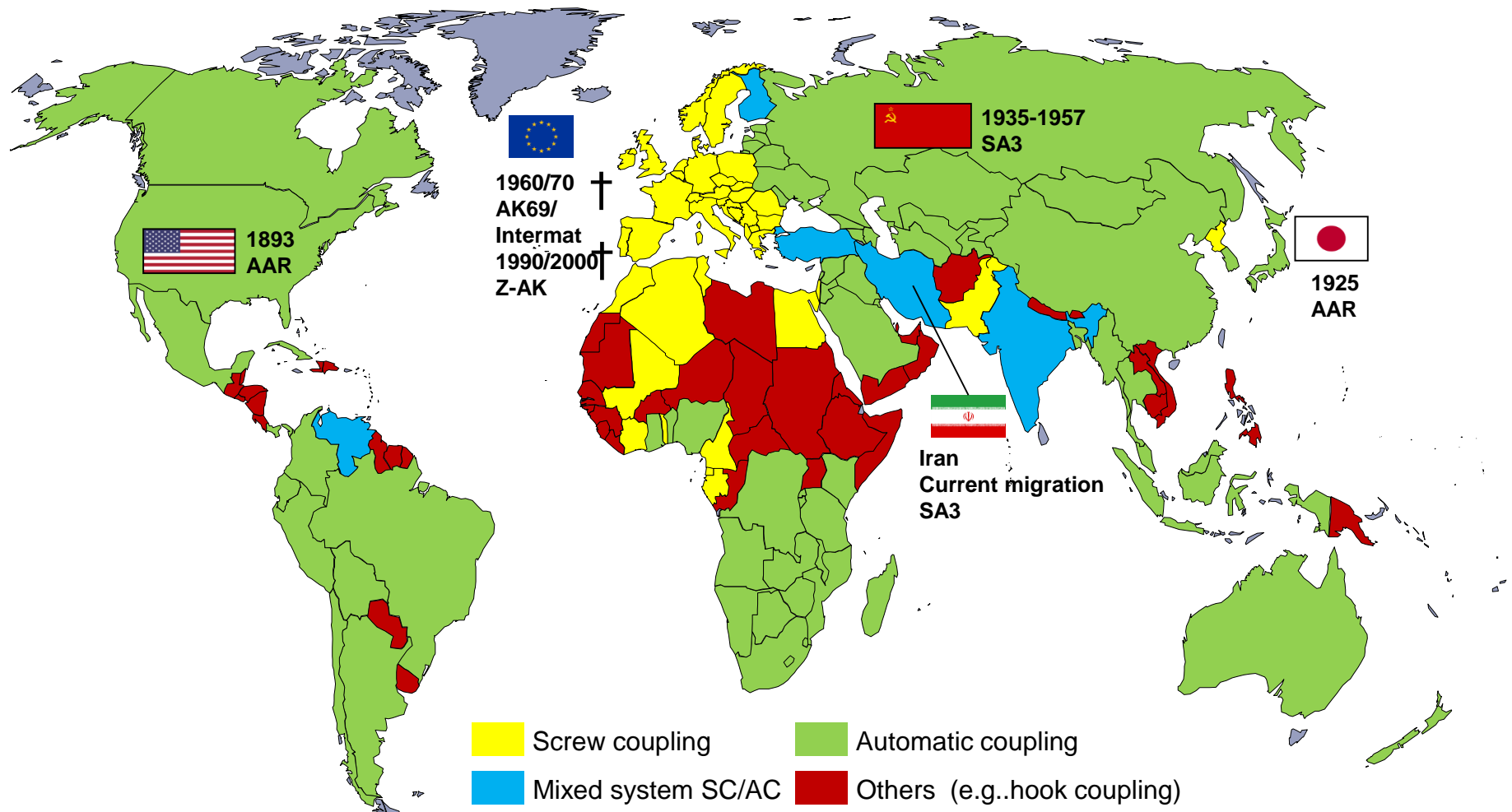


### 4. Electro-pneumatic brake



Source photos: SBB Cargo, DB Cargo, VTG

# Automatic couplings have been introduced worldwide since the end of 19th century in rail freight - but not so in Europe



Source: Sünderhauf



## In the meantime however the general conditions in rail freight transport have changed significantly

### Early 20th century



AC for the reduction of  
shunting accidents

### Late 20th century



AC for increasing  
productivity in shunting  
operations

### 21st century



DAC as a prerequisite for the  
automation and digitization of  
rail freight transport in Europe

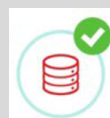
With increasing **digitization** and **automation** in rail operations, many applications are in development that will allow to significantly increase the attractiveness and productivity of rail freight transport.

### The following prerequisites must be met:

Sufficient energy  
supply



Secure intrain data  
transmission



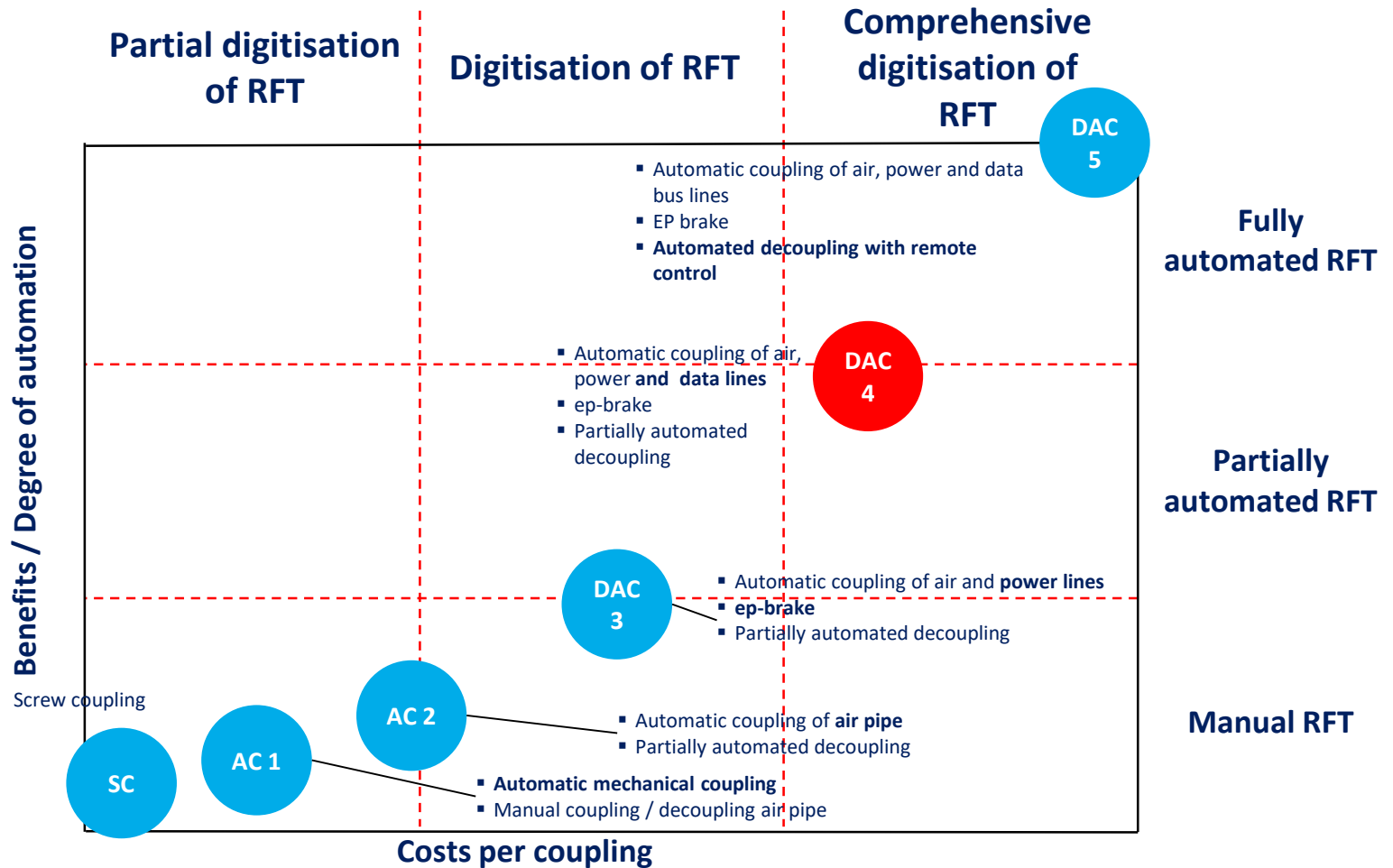
Automatic coupling /  
uncoupling



Digital automatic  
coupling with electrical  
power line and data bus



# TIS supports the introduction of a Digital Automatic Coupling (DAC) Type 4 in Europe



Upward compatibility of AC 1 – AC 5 is required

## In recent years there have already been various activities on DAC in the sector



- AC type 2 demonstrator („5L“-demonstrator“)
- Rollout AC type 2 in 100 intermodal wagons in April 2019
- Exhibition of prototypes DAC type 4 on transport logistic



- TIS position paper on DAC in autumn 2018
- TIS white book on intelligent freight trains (incl. DAC) in June 2019
- TIS action plan on DAC with 8 topics



- AC type 2 demonstrator „Innovative freight wagon-project“)
- Project „Digital automatic coupling for automation of rail freight transportation in Europe“



- Voith: development DAC type 4 Scharfenberg
- Wabtec: development DAC type 4 Schwab
- CAF: development DAC type 4 SA3



- DAC part of masterplan for rail freight transportation
- Project on migration strategy DAC initiated



TRAFIKVERKET



- Member of Shift<sup>2</sup>Rail project on DAC
- Demonstrator project of various DAC type 4 in Sweden in 2020

## Prerequisite for DAC-migration: one European standard

**Currently three manufacturers are developing type 4-couplers with different coupler heads.**



**Type Scharfenberg**



**Type Schwab**



**Type SA3**

**On the way to ONE standard European DAC a coupler head has to be selected. Based on the selected coupler head interfaces (mechanical part coupler/wagon and coupler/coupler, air pipe, electrical power lines and data bus) have to be standardized.**

**TIS has initiated an industry platform with various manufacturers in order to standardize DAC.**

# German Ministry of Transport (BMVI) has launched a study on migration strategy DAC

## WP 1: Market overview / state of the art

- Existing freight wagons (amount, age, suitability for migration DAC)
- State of the art DAC
- R&D activities DAC
- National and EU-wide legal framework DAC
- Identification of relevant stakeholders
- Stakeholder plans for migration of DAC
- Standards in electrical power supply and intrain data transmission.

## WP 2: migration concept

- Sector-wide process on a coupling type DAC
- Framework for the establishment of a standard
- upward / downward compatibility of various DAC types (1-5)
- Parallel operations of DAC/SC\*
- Organizational set-up for roll-out DAC
- Financing / cost distribution model
- Legal / regulatory impact of migration

## WP 3: roadmap migration

- Development of a roadmap migration DAC
- Recommendations for the support of R&D, pilots, migration by the ministry
- Identification of obstacles for implementation of DAC

## Making rail transportation more competitive

A strong rail freight sector needs a more competitive structure. This includes both an efficient infrastructure as well as financial and political support for research and the roll out of technology.

**Outlook –  
making rail  
transportation  
more competitive**

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# Outlook intelligent freight train

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## **The intelligent freight train has a digital automatic coupling**

- Without DAC, complete automation of RFT is not possible
- No migration without agreement on a standardised coupling head and a coordinated migration strategy

## **Standardisation of energy and data management**

- Uniform European concept to energy and data management required

## **Sector and political authorities must pull in the same direction**

- Efforts needed to involve all stakeholders in the concept.
- Political and financial support of the sector required.

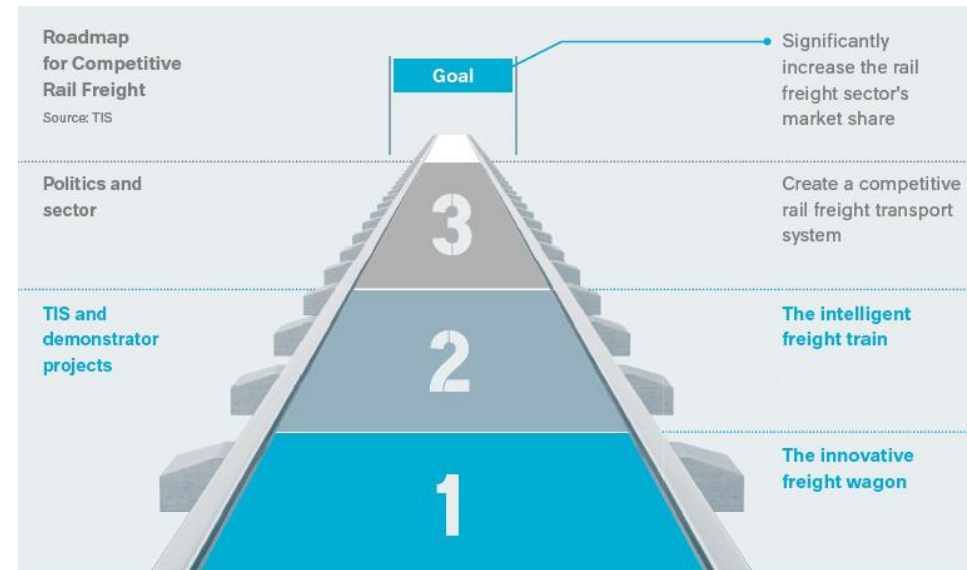
## **Working together for the success of the intelligent freight train**

- Individual companies can not put the Intelligent Freight Train on its own - making a huge effort on the whole sector necessary.
- All stakeholders need to get involved.



# The TIS concept IF<sup>2</sup> is an important building block for achieving the climate change targets

- Innovative freight wagons and intelligent freight trains increase the productivity and logistics capability in rail freight transport.
- In addition, sector and political authorities must create favorable framework conditions for a competitive RFT system.
- This is the prerequisite for a clear modal shift to the railways.
- Innovative freight wagons and intelligent freight trains (IF<sup>2</sup>) are thus important building blocks for achieving climate change targets in the transport sector.



**Thank you for you attention!**

Further informationen about TIS can be found on the website

[www.innovative-freight-wagon.eu](http://www.innovative-freight-wagon.eu) / [www.tis.ag](http://www.tis.ag)

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