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Università Commerciale Luigi Bocconi

AN ECONOMIC MODEL FOR THE EVALUATION OF DIFFERENT TECHNOLOGICAL SCENARIOS IN THE RAIL SECTOR

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Contents

Framework for innovation in the EU rail sector

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ERTMS

The European Rail Traffic Management System (ERTMS) is an initiative to enhance cross-border interoperability and the procurement of signalling equipment by creating a single Europe-wide standard for train control and command systems.

GALILEO

Galileo is the global navigation satellite system (GNSS) that is currently being created by the European Union (EU) and the European Space Agency (ESA).

INNOVATION IN TRAIN CONTROL SYSTEMS

The sector of train control

→ State of the art train control is based on Eurobalises (balises complying with ETCS standard)

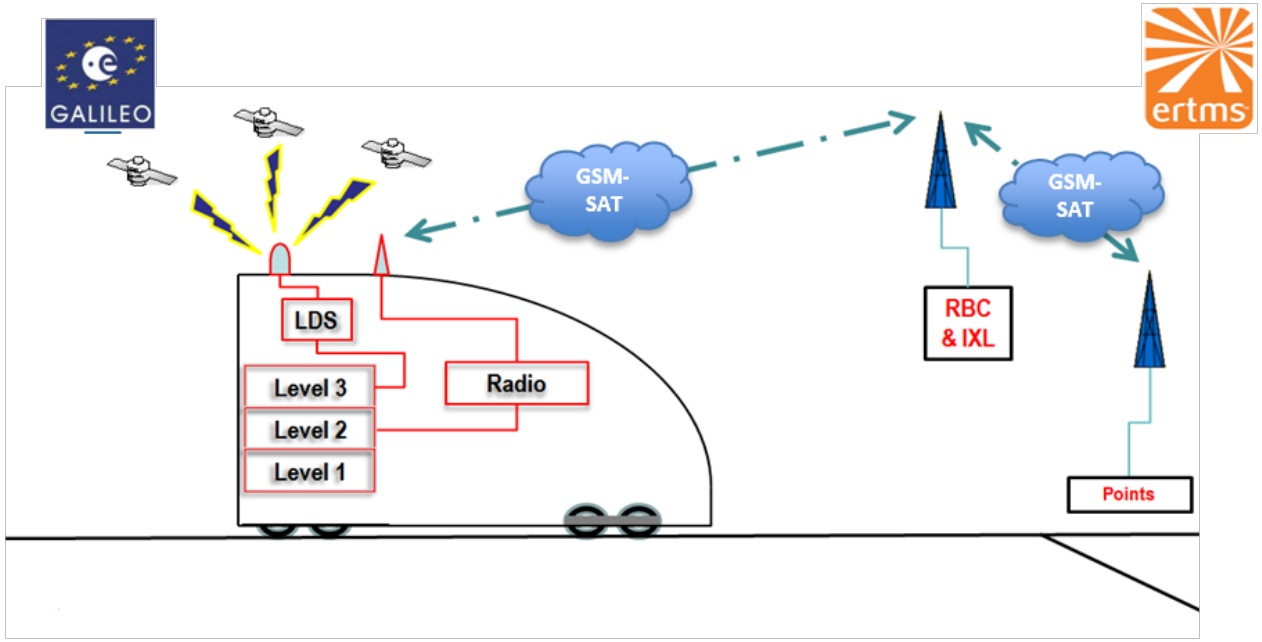
→ The market of Trail Control systems is the fastest growing segment (after the Integrated Projects) of the global rail market, and it can be quantified in 5 billion Euro per year in Western Europe.

→ The global rail control market is expected to record a strong growth rate in 2015-2017 at 3.0-3.5% per year, with the roll-out of ERTMS and Positive Train Control being the main driver of this trend. The forecast growth in Europe is slower at 1.5-2.0% per year.

→ The main providers in the market of train control and signaling solutions are Ansaldo STS, Alstom, Bombardier, Hitachi, Siemens, and Thales (which accounts for 30% of the ECTS global market).

→ Increasing standardization of rail signalling solutions is one of the most important trends impacting the market today. Standardization allows suppliers to develop core, standards-based global architectures that both enable the interoperability necessary to meet local safety requirements and provide a common, reliable platform for building local solutions.

Innovation in train control systems: the introduction of GNSS-based technologies



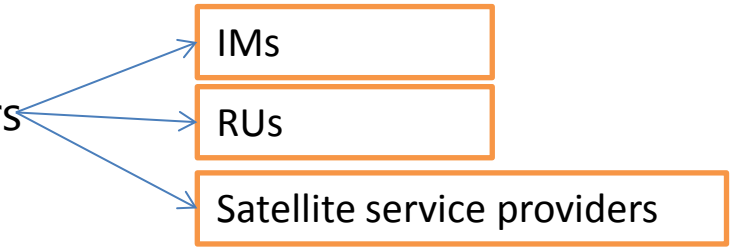
The GNSS would be incorporated in the European train control system (ERMTS-ETCS)

→The space segment would provide the reference satellite system allowing the identification of the train position
→ the on board units would be responding to the satellite using the GNSS signal
→ the augmentation and integrity monitoring would be an alternative implemented in some areas not covered by EGNOS signal

Economic evaluations: aims and tools

AIMS

→ Business case for developers
→ Impact for other stakeholders
→ Public point of view



TOOLS

→ Business plan
→ LCC analysis, economic projections and indicators (NPV, ROI)
→ Cost-Benefit Analysis

Economic evaluations: aims and tools

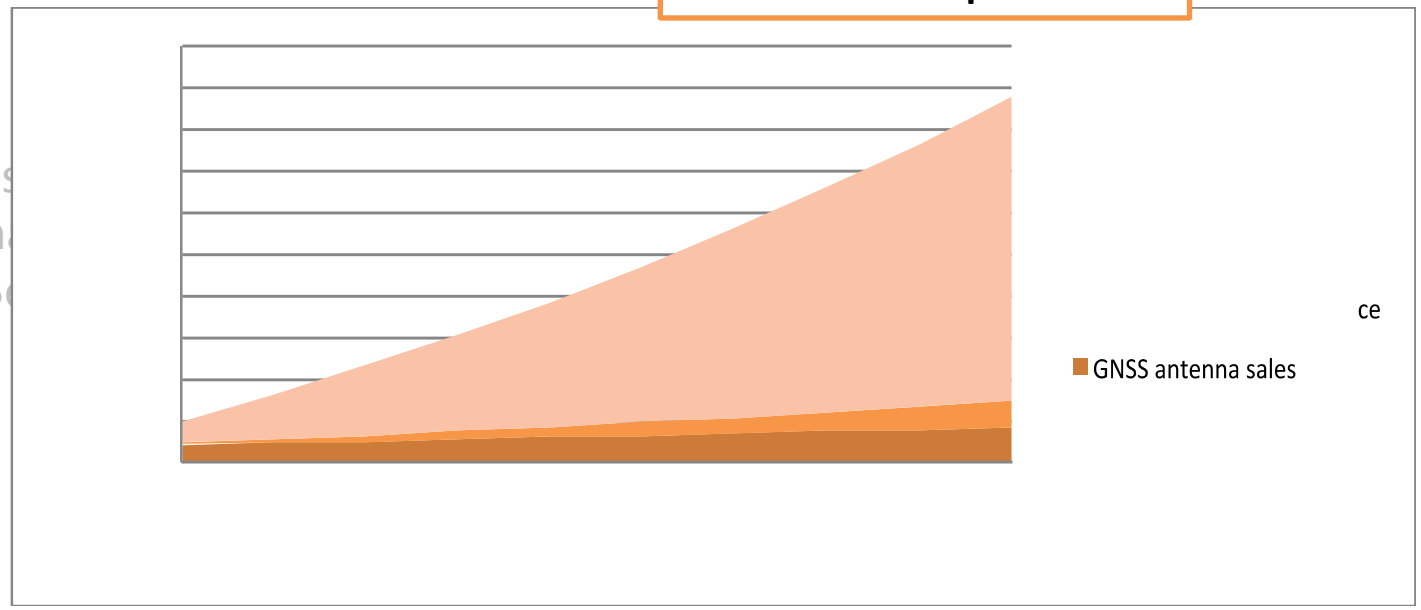
AIMS

→ Business case for developers
→ Impact for other stakeholders
→ Public point of view

- IMs
- RUs
- **Satellite service providers**

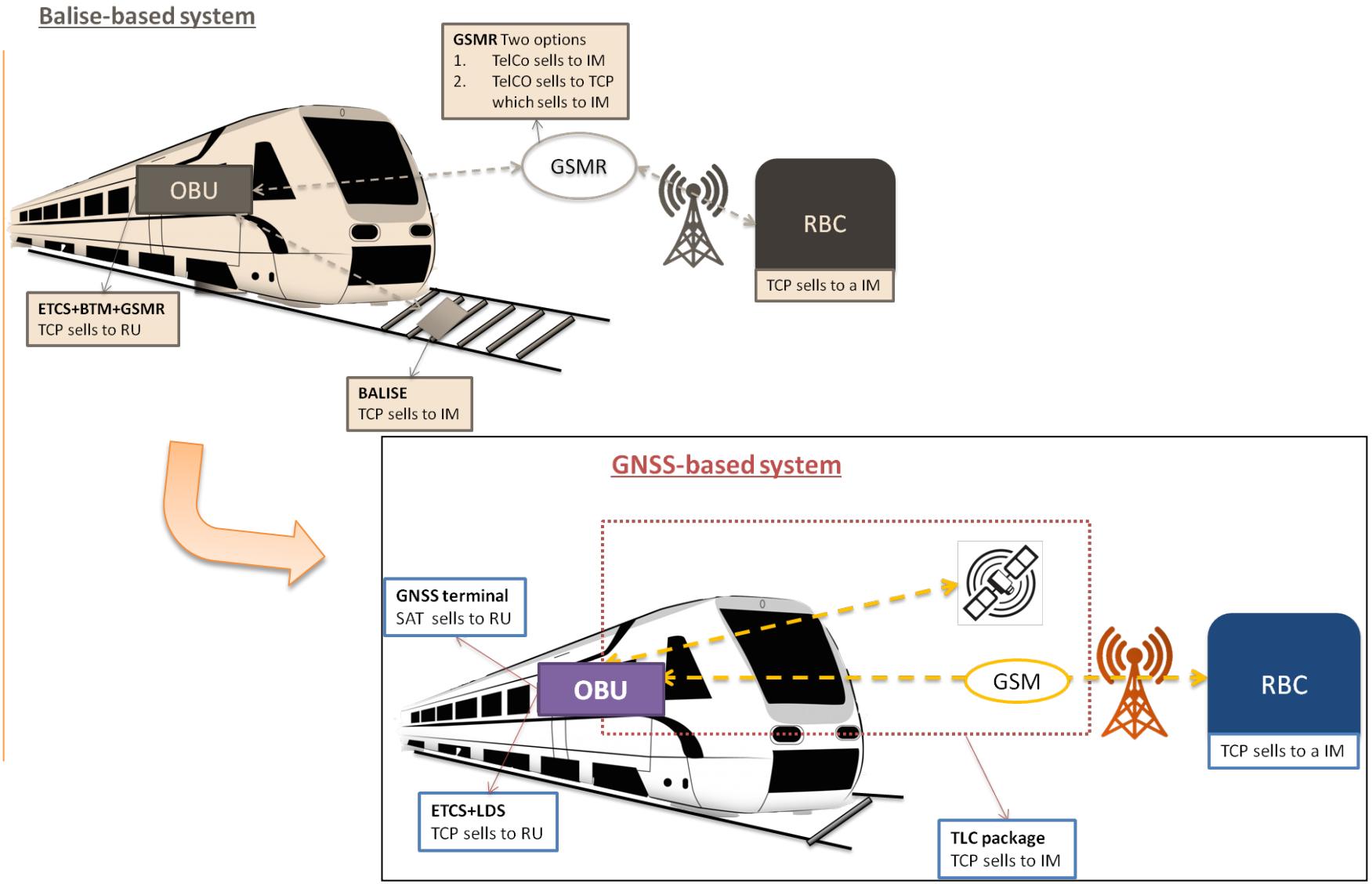
TOOLS

→ Busines
→ LCC an
→ Cost-B



Application

Impact for Infrastructure Managers



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Impact for infrastructure managers

TOOL: LCC ANALYSIS AND FINANCIAL INDICATORS

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		GNSS-BASED SOLUTION	Balise-based solution
Investments	Ground		
	RBC		
	Board equipt		
Operating Costs	EGNOS		
	TLC		
	Eurobalises		
	Maintenance		

Impact for infrastructure managers

TOOL: LCC ANALYSIS AND FINANCIAL INDICATORS

		GNSS-BASED SOLUTION	Balise-based solution
Investments	Ground		
	RBC		
	Board equipt		
Operating Costs	EGNOS		
	TLC		
	Eurobalises	Not present	Definition of an economic model for the use of balises
	Maintenance		

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Eurobalises: economic model

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1) Estimation of the number of yearly failures of the BTM-balise communication in the concerned network

2) Estimation the average number of yearly breakdowns of balises

3) Estimation of the average cost of intervention for balise maintenance

4) Calculation of the total yearly cost for balise maintenance in the concerned network

5) Calculation of the average yearly maintenance cost per balise

Eurobalises: economic model

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2) Estimation the average number of yearly breakdowns of balises

3) Estimation of the maintenance

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Source: the IM itself or adaptation from available figures for the Italian network

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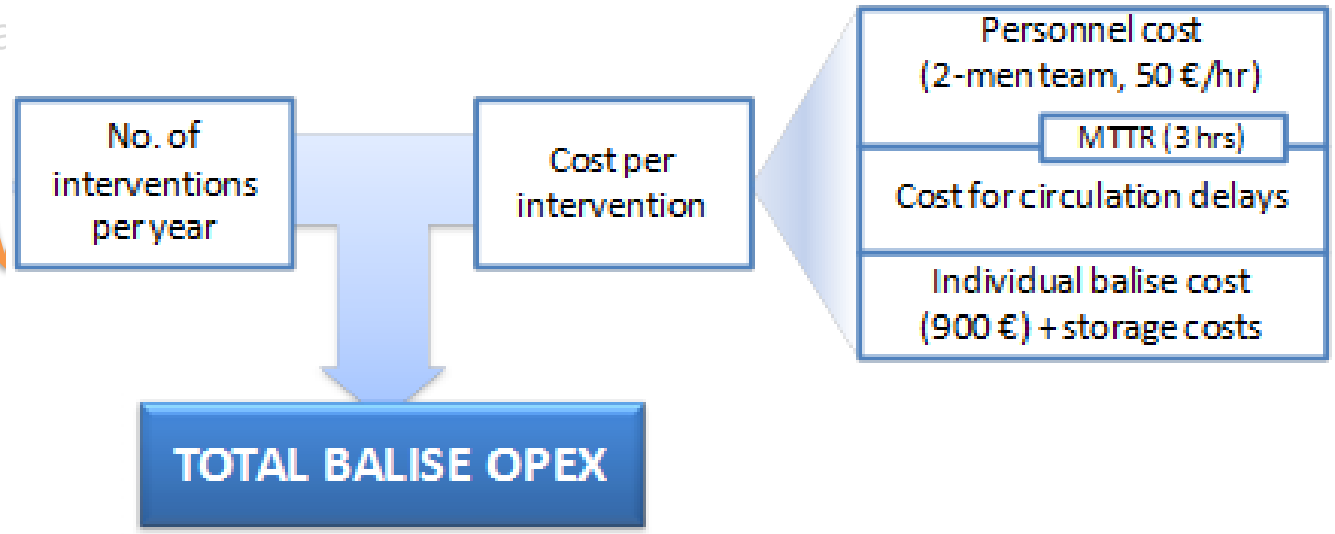

Eurobalises: economic model

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Estimation results still very variable in a wide range (90 – 400 Euro per balise per year)

Conclusions

→ Definition of the set of tools and methodological approach (scenario comparison) approved by authorities

→ Application of the Cost-Benefit Analysis proved solid and replicable (e.g. the Sardinia case)

→Economic models to be defined for each relevant item heavily rely on operators's data availability to allow for sound comparison thoughout Europe

→ Relevant strength and oppportunities for GNSS-based train control system

→ Research is ongoing