



HIGH-SPEED RAIL : THE RIGHT SPEED FOR OUR PLANET Under the High Patronage of his Majesty King Mohammed VI

# Session1.2 Room Karam1 Economy / Socio economical and territorial impacts



Moderator : Mr. Michel Leboeuf Honorary Chairman of UIC Intercity and High-Speed Committee, UIC, France







## Session1.2 Economy / Socio economical and territorial impacts Speaker Lists;







HIGH-SPEED RAIL : THE RIGHT SPEED FOR OUR PLANET Under the High Patronage of his Majesty King Mohammed VI

## 11<sup>TH</sup>WORLD CONGRESS OF HIGH-SPEED RAIL

Marrakech, 7-10 MARCH 2023

# An innovative framework for integrating Cost-Benefit Analysis (CBA) within Building Information Modeling (BIM)

Michele GESUALDI Project Manager & Advisor High-Speed Rail UIC (Union International des Chemins de fer) Session 1.2 Economy / Socio economical and territorial impacts







Morocco 2023



HIGHSPEED

#### METHODOLOGY

Marriage between CBA and BIM is the union between infrastructural and transport planning

#### STEP 1 STEP 2

Digitalization of the design projects of Napoli-Bari HSR corridor Integration and association of CBA input data into the geometrical model

STEP 3 STEP 4

Creation of algorithm for CBA automatization Comparison of design alternatives and grafical output WHY CBA-BIM?

#### REALIBLE AND TRANSPARENT DATA

The BIM model includes all CBA data, including financial, social, and environmental impacts.

#### INVOLVMENT OF ALL STAKEHOLDERS

Improving of public debate, avoiding disputes and bureaucratic delays

#### PROCESS STANDARDIZATION

Standardization of the decisionmaking to boost project planning time

PROCESS AUTOMATIZATION

Automatization of CBA process and calculation, preserving design



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OUTCOME



OUTPUT DATA

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#### **CBA-BIM CONCEPT**

BIM Commission BIM, short for Building Information Modelling, is a digital tool for central integrated design, modelling, asset planning, running and cooperation. It provides all stakeholders with a digital representation of a building's characteristic in its whole lifecycle.

European

CBA Commission CBA, short for Cost-Benefit Analysis, is a process or tool support decision making in projects. CBA evaluates the cost versus the benefit of a project to determine project feasibility as well as provide decision making metric when weighing up multiple options.

European



#### CBA-BIM /si-bä-bim / noun

- 1. The concatenation of Cost-Benefit Analysis (CBA) with Building Information Modeling (BIM). Or the addition of traditional planning-based cost benefit decision making tools to the design process.
- 2. The process of evaluating the costs, benefits and risk of proposed infrastructure systems at the speed of design using 3D digital representations of physical and functional characteristics of projects to answer to the question "what is in it for me".
- A set of decision-making tools that help engineers, project sponsors, infrastructure financiers decide what to build, how to build it, what the risks are, and who benefits.





#### WORKFLOW PHASES







#### CASE STUDY: NAPOLI – BARI HIGH SPEED RAIL CORRIDOR









### BIM-BASED TOOLS







#### **DESIGN PHASES**







#### **DESIGN PHASES**

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#### **CBA AUTOMATIZATION**







#### **CBA AUTOMATIZATION**







#### **CBA-BIM RESULTS AND IMPACT ANALYSIS**







### CONCLUSION



#### ••• SUSTAINABLE GOALS

As a result of objective evaluation of wide range of financial, social and environmental factors



#### ••• BETTERSTAKEHOLDERENGAGEMENT

As a result of reliable and transparent data



#### ••• FASTER DECISION-MAKING

As a result of process automatization







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# HIGH SPEED RAIL AS A COMPLEX MOBILITY AND INNOVATION DRIVER

Miroslav Haltuf Director, H-Comp Consulting, Czech Republic Session2-1.2 Economy / Socio economical and territorial impacts













#### HSR - SOCIO-ECONOMIC IMPACT ON SOCIETY AND TERRITORY How HSR is affecting the mobility of people and goods in Central and Eastern Europe?



- According to foreign experience, HSR can mitigate depopulation in less developed areas;  $\geq$
- There is the issue of the small size of the Czech Republic and insufficiently large agglomerations;  $\geq$

#### HIGH SPEED RAIL AS A COMPLEX MOBILITY AND INNOVATION DRIVER

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How does the demographic structure of the population affect the development and use of HSR?





#### HIGH SPEED RAIL AS A COMPLEX MOBILITY AND INNOVATION DRIVER

**HIGH**SPEED





Is it better to change the mobility of citizens and the industrial development of a territory or is it more efficient to change the routing of HSR and the configuration of the rail network?



HIGH SPEED RAIL AS A COMPLEX MOBILITY AND INNOVATION DRIVER





Is it better to change the mobility of citizens and the industrial development of a territory or is it more efficient to change the routing of HSR and the configuration of the rail network?









Will new HSR lines significantly affect the capacity of existing conventional lines in favor of rail freight transport?



Moving passenger trains with operation speeds of 140kmph+ over to the new HSR lines will

- Increase of capacity by 30%
   on mixed traffic lines
- Increase of capacity for freight by only up to 20%







How to integrate HSR into urban mobility and ITS concepts?

High-speed rail station:

- Hub that passengers can access using various modes of public transportation.
- From this hub passengers can travel from their point of origin to point of destination.
- The transportation modes connected vary depending on their location in the city and the land use surrounding the hub. They also differ from the modes that connect to bus stops or subway stations because high-speed rail travel is different in nature from travel by bus or subway.

#### Each HSR station:

- Combines a unique set of connection modes, facilities and accessibilities
- Offers travelers a different experience depending on variables such as arrival intervals, travel time, transfer time and convenience, parking facilities, etc. These variables influence ridership.

If travelers perceive poor value in the services offered by high-speed rail and its connecting modes, they are naturally more likely to use other modes of transportation to their destination. Even travelers who do ride high-speed rail may use connection modes other than public transportation.

#### A set of fact-based guidelines for multimodal connectivity at high-speed rail stations is essential.





Possibilities and challenges of low-emission high-speed rail transport



Inspiration in Japan

HSR is♦not only transportation,♦but also transformation.





### HSR - SOCIO-ECONOMIC IMPACT ON SOCIETY AND TERRITORY - CONCLUSIONS

The most important indicators for decision making processes to develop as fast as possible the HSR in Central and Eastern European Countries







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# THANK YOU FOR YOUR ATTENTION!



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# A STUDY ON THE MUTUAL ENHANCEMENT OF REGIONAL ECONOMY AND PERSONAL QOL ALONG THE MUMBAI-AHMEDABAD HIGH-SPEED RAIL CORRIDOR IN INDIA

Shuji, Sugimori Manager, East Japan Railway Company, Japan Session2-1.2 Economy / Socio economical and territorial impacts Contributors: Yoshitsugu Hayashi, Tsuyoshi Takano and Hiroyuki Takeshita







#### Mumbai–Ahmedabad High-speed Rail (MAHSR)





Population along the MAHSR corridor				
Gujarat State	Ahmadabad	7,214,225		
	Kheda	2,299,885		
	Anand	2,092,745		
	Vadodara	4,165,626	26,440,172	
	Bharuch	1,551,019		
	Surat	6,081,322		
	Navsari	1,329,672		
	Valsad	1,705,678		
Maharashtra State	Thane (incl. Palghar)	11,060,148	22 502 521	
	Mumbai	12,442,373	20,002,02	
	Total		49,942,693	







#### Focus of the study

- As a method to evaluate the benefits by High-speed rails (HSRs), the conventional cost-benefit analysis (CBA) targets the direct benefits to HSR users, however, the importance of capturing indirect benefits to non-users such as the 'Wider Economic Impacts' have also been broadly discussed.
- It is more likely that the money is used to increase the level of happiness, or quality of life (QOL), obtained from various values, such as leisure time and access to medical care. This approach is linked to "No one left behind" in the SDGs of the United Nations (Hayashi et al., 2021).
- We modeled and estimated the mutual enhancement of regional economy and personal QOL, along the Mumbai-Ahmedabad HSR (MAHSR) corridor in India as a case study.





Model system of HSR benefits













#### METHODOLOGY (1)

#### Preconditions of the estimation

	Without MAHSR	With MAHSR			
Intercity modal share (Estimated by JICA)	Mumbai-Ahmedabad 15% 30% 16% 40% Mumbai-Vadodara 9% 19% 30% 42%	Mumbai-Ahmedabad 13% 66% 12%9% Mumbai-Vadodara 11% 58% 14% 17%			
	Mumbai-Surat 1 <mark>%20% 30% 49%</mark>	Mumbai-Surat 9% 42% 18% 31%			
	0% 20% 40% 60% 80% 100% ■ Air ■ Rail ■ Bus ■ Car	0% 20% 40% 60% 80% 100% ■ Air ■ Rail ■ Bus ■ Car			
Generalized	Ahmedal Kheda Anand Vadodar Bharuck Surat Navsari Valsad Thane Mumbai	Ahmedal Kheda Anand Vadodar Bharuck Surat Navsari Valsad Thane Mumbai			
travel cost <i>GC<sub>i i</sub></i>	Ahmedabad         249         592         958         1,252         1,996         2,688         2,944         3,232         4,831         5,573           Kheda         592         223         419         792         1,572         2,232         2,526         2,820         3,466         5,197	Ahmedabad         249         498         955         1,252         1,996         2,564         2,818         2,994         3,919         4,307           Kheda         498         223         377         792         1,572         2,232         2,526         2,753         3,466         4,240			
between	Anand         958         419         193         439         1,227         1,853         2,156         2,459         3,204         5,041           Vadodara         1,252         792         439         323         914         1,550         1,853         2,166         2,920         4,805	Anand         955         377         193         397         1,227         1,853         2,156         2,459         3,204         4,241           Vadodara         1,252         792         397         323         885         1,550         1,853         2,166         2,920         3,897			
each zone	Bharuch         1,996         1,572         1,227         914         387         712         1,035         1,348         2,428         3,732           Surat         2,688         2,232         1,853         1,550         712         267         419         722         1,820         3,064         I	Bharuch         1,996         1,572         1,227         885         387         682         1,035         1,348         2,428         3,530           Surat         2,564         2,232         1,853         1,550         682         267         419         722         1,820         2,903			
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by the author)	Thane         4.831         3.466         3.204         2.920         2.428         1.820         1.506         1.146         545         1.136           Mumbai         5.573         5.197         5.041         4.805         3.732         3.064         2.559         2.322         1.136         551	Thane         3.919         3.466         3.204         2.920         2.428         1.820         1.506         1.116         545         1.136           Mumbai         4.307         4.240         4.241         3.897         3.530         2.903         2.421         2.216         1.136         551			





## RESULTS (1)

#### Regional economic impacts by industry and by zone







### METHODOLOGY (2)

QOL Accessibility Method to estimate the personal QOL impacts (Hayashi, 2020)



 $A_{i}^{m} = \sum_{j} \{ V_{j}^{m} \times \exp\left(-\alpha^{m} \times C_{ij}^{m}\right) \}$ (5) Accessible value of service  $P_{i}^{km} = w^{km} \times A_{i}^{m}$ (6) Perceived value V

$$QOL_{i}^{k} = \sum_{m} P_{i}^{km}$$
Quality of Life m Perceived for person k in zone i value





## METHODOLOGY (2)

#### Questionnaire Survey for Conjoint Analyses

An example of question

1. In the following questions, two sites with differing conditions are described side-byside. Given a choice if you were to relocate from your current residence, please indicate the site of your preference?

	Site A	Site B
Commuting Time	20% LESS	20% MORE
Job Opportunity (Jobs per Working Population)	80 in 100	120 in 100 20% LESS
Travel Time to Shopping Centre	20% MORE	
Housing Cost/Rent	20% MORE	20% LESS
Mark only one oval per row.		
Site A Site B		

#### QOL factors

Category	Factors		
	Access to office		
Economic Opportunity	Job Opportunity		
	Residence		
	Medical Care		
	Educational Opportunity		
Living and Cultural Opportunity	Tourism		
	Shopping Opportunity		
	Recreational Opportunity		
	Comfort of Living		
Residential Amenity	Cleanliness		
	Greenness		
	Safe neighborhood		
Safety and Security	Road Safety		
	Disaster Risk		
	Air Pollution		
Burden on Environment	Noise Pollution		
	Water Quality		





## RESULTS (2) Personal QOL impacts additionally enhanced by the regional economic impacts







#### CONCLUSIONS Summary of the study

- We modeled and estimated the mutual enhancement of regional economy and personal QOL as indirect benefits of the Mumbai–Ahmedabad high-speed rail (MAHSR), which is currently under construction as the first HSR for India.
  - The results show that the MAHSR will bring QOL impacts throughout the whole corridor region where the accessibility is improved by the MAHSR.
  - This method can evaluate also the interregional disparity by identifying the differences in benefit by person according to age, income, etc., which cannot be evaluated based on a mass measure, gross domestic product (GDP), in the conventional CBA. This method can quantitatively evaluate "No one left behind", as stated in the SDGs, and is expected to be utilized in various future policy evaluations in a society with diverse values.





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# THANK YOU

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# **NORDIC HSR**

Alf S. Johansen Project advisor, Norway Session2-1.2 Economy / Socio economical and territorial impacts







#### NORDIC REGION









## NORDIC COUNCILS' VISION 2030:

## "Our vision is that the Nordic Region will become the most sustainable and integrated region in the world by 2030"







## CURRENT MOBILITY SITUATION

Heavy air traffic dependency !

#### 5 busiest Nordic airports 2019, at the Europe top 100:

(30 million pass.)	17 in Europe
(29 million pass.)	21 in E
(27 million pass.)	25 in E
(22 million pass.)	30 in E
(7 million pass.)	71 in E
(6 million pass.)	76 in E
(4 million pass.)	100 in E
	<ul> <li>(30 million pass.)</li> <li>(29 million pass.)</li> <li>(27 million pass.)</li> <li>(22 million pass.)</li> <li>(7 million pass.)</li> <li>(6 million pass.)</li> <li>(4 million pass.)</li> </ul>



FLYSTREIK: Norwegian er blant selskapene som den siste tida har innstilt en rekke flyavganger som følge av streik blant flyteknikere. Foto: Shutterstock / NTB

Total: 125 million pass.





## CURRENT MOBILITY SITUATION

#### Heavy car and lorry traffic on main roads between Norway and Sweden/Denmark







## OECD/OTHERS POINT AT MISSING LINKS IN SCANDINAVIA:

- · Lack of modern railways, capacity and effiency on the railways
- Long transport time and low capacity for cargo on rails
- Long travel time for people with trains. 7-8 hours (500-600 km)
- Heavy car and lorry traffic on the main roads
- Need for double tracks, between Oslo and Gothenburg/Stockholm
- Need for deployment of high speed trains between Norway and Sweden











#### HOW TO REDUCE TRAVEL TIME WITH RAILWAYS BETWEEN THE 3 SCANDINAVIAN CAPITAL CITIES ?

- HIGH SPEED RAILWAYS (DOUBLE TRACKS) ARE NEEDED
- TRAVEL TIME SHALL BE REDUCED FROM 7-8 HOURS TO 2-3 HOURS
- FREQUENCY SHALL BE RAISED FROM 6-8 TRAINS/DAY TO 4-6 TRAINS/HOUR
- HIGH SPEED TRAINS SHALL SERVE A NUMBER OF STATIONS PER HOUR
- SOME TRAINS SHALL GO DIRECTLY BETWEEN THE MAJOR CITIES. OTHER TRAINS WILL STOP AT MEDIUM SIZED TOWNS AND SERVE THE REGIONAL MARKET
- LOCAL GOVERNMENTS AND METROPOLITAN REGIONS NEED TO STEP UP AND FORM HIGH SPEED RAILWAYS BETWEEN THE URBAN NODES. STRUGGLE WITH NATIONAL GOVERNMENTS OVER BUDGETS AND PRIORITIES TAKES TOO LONG TIME AND TOO MUCH WASTED ENERGY















Traffic on high-speed rail will double **by 2030**. **By 2050** rail freight traffic will double.







## FUNDING OF NORDIC HSR RAILWAYS

- National states budgets are already committed for other projects until 2040. The struggle for a secure place for HSR on these national priority lists are hopeless.
- Commercial funding is the targeted solution as the primary source for HSR in Scandinavia. This means risk capital and loans, as the market is expected to pay back the investments during 20-30 years
- EU and national states may contribute with limited amounts, grants, loans or garantuees









THE NORDIC HSR VISION IS TO CREATE A FAST TRAIN LINK TO THE GLOBAL GRID OF HIGH SPEED RAILWAYS. THEREFORE WE HAVE TO APPLY THE FASTER, CHEAPER AND SMARTER CONSTRUCTION AND FUNDING METHODS, IN ORDER TO REACH THE GOALS WITHIN 2040.









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# THANK YOU

