

# Wider Effects of Railways

## The Palermo-Catania High-Speed line, Italy

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# Agenda

- 1 | Introduction – Legal Framework and Global Project Palermo - Catania
- 2 | Applied Methodologies
- 3 | Case Study: New connection Palermo - Catania

# Wider Economic Impacts

## The Legal Framework

2016



**The Italian Public Contracts Code**  
(D. Lgs. 50/2016)

According to the standard, interventions are included in the Multiannual Planning Document (DPP) on the basis of the economic and financial feasibility assessment.

2017



**Guidelines for the Evaluation of Investments in Public Works**  
(D.M. 300/2017 del MIT)

Indirect impacts of a transport investment are defined as those impacts on other macroeconomic sectors and markets that may result from interventions in transport supply (e.g. impacts on employment, demographics, housing and others).

2021



**Guidelines for the drafting of the Technical-Economic Feasibility Project to be used as a basis for the awarding of public works contracts of the NRRP and PNC(L. 108/2021)**

In addition to the CBA, the socio-economic and employment impact analysis and the sustainability report are introduced as further decision-making tools to be taken into account.

2021



**Operational Guidelines for the Railway Sector**  
(D.M. 496/2021 del MIT)

The Guidelines suggest that the social dimension of transport infrastructure should be considered in the presentation stage. When assessing the social impacts of an infrastructure, it is necessary to evaluate the expected impacts both in the medium to long term (caused by the operation of the infrastructure) and in the short term (caused by the construction of the infrastructure).

2023



**The new Italian Public Contracts Code**  
(D.Lgs. 36/2023 e s.m.i.)

Investments in public works are included in the economic and financial document, "with an indication of the expected performance criteria in terms of infrastructure development, socio-economic rebalancing between areas of the national territory, environmental sustainability, ..." (art. 39 comma 3.a).



**Additional impacts generated by the investment (not strictly transport-related) are not made explicit**



**Impacts that are not strictly transport-related and not considered in the CBA are introduced**



**Alongside the environmental part (geological, ...), the Council began to focus on issues related to economic growth, development and productivity**



**The guidelines provide a list of possible impacts to be considered beyond the scope of the CBA (accessibility, equity, employment, attractiveness of the area...)**

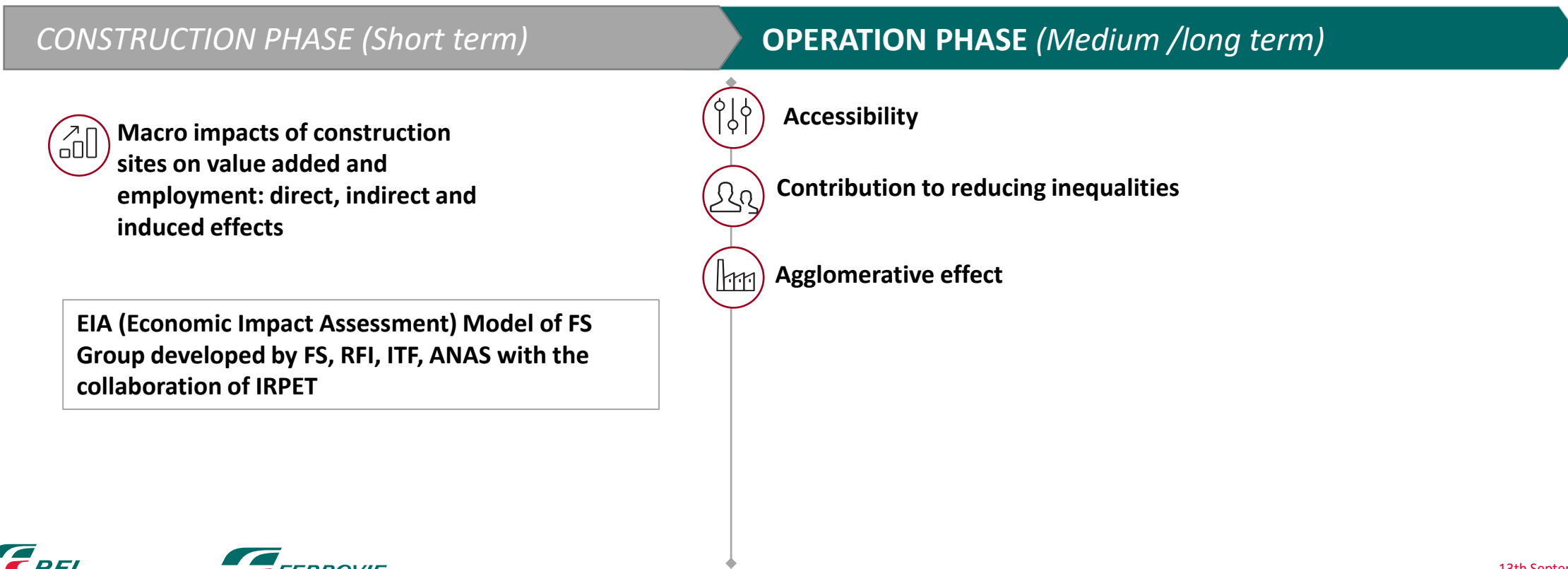


**The new Italian Public Contracts Code introduces other criteria for the evaluation of a railway infrastructure project, in addition to economic and financial feasibility**

# Wider Economic Impacts

## Short and medium/long-term impacts

The following **socio-economic and territorial impacts** are **not included** in the perimeter of the **Cost Benefit Analysis** because they are **not strictly related to transport**, as defined in the Ministerial and European guidelines. **RFI** has **prepared some internal tools to assess these impacts**, which are related to the same perimeter of intervention considered in the Transport Study and in the Cost Benefit Analysis, in order to **satisfy the requests of institutional stakeholders** such as the Special Committee of the **CSLLPP**, the **CIPESS** and for **Public Debates**:



# Palermo – Catania Case study

## Global Project



The project envisages upgrading the **Palermo-Catania** link on the 178 km section from **Fiumetorto** to **Bicocca**, increasing the **capacity** of the existing single track line and raising the **speed** limit to 200 km/h.

The Global project includes two macro-phases, as follows:

→ **First Macrophase:** double track Bicocca-Catenanuova and Fiumetorto-Lercara, new single fast track Lercara - Catenanuova with safety tunnels parallel to the long tunnels of the enlarged section;

→ **Second Macro-phase:** activation of the double track sections and variations to the historical line between Lercara and Nuova Enna.

The **total cost** of the Investment Programme is estimated at a total of **7,913.4 million euro**.

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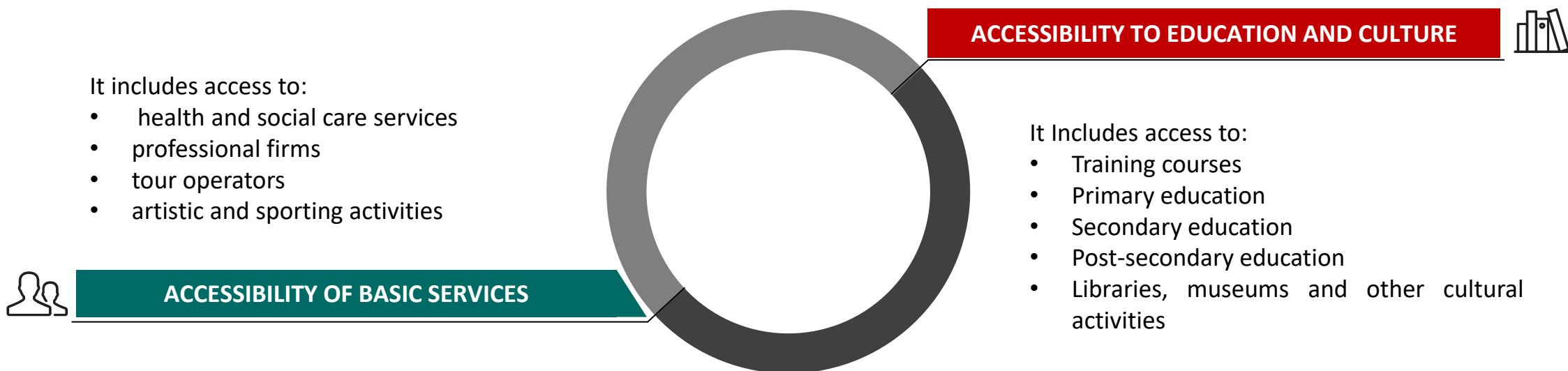
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# Accessibility measures

## Macro statistical-indicators

- The analytical concept of **accessibility** represents the ability of an area to have access to **relevant markets**: in the absence of infrastructure linking different regions, this advantage is determined solely by geography. Transport infrastructure, on the other hand, reduces the **generalised cost of transport** (CGT) and the actual distances between connected areas. We could say that cities located on a railway line are actually "closer" to each other.
- **Two macro-indicators** have been defined to measure accessibility, representing respectively:



# Accessibility measures

## Methodological note

**H0** = baseline scenario  
**H1** = project Scenario  
 $T_{0od}$  = travel time of baseline scenario  
 $T_{1od}$  = travel time of project scenario  
**Add** = number of employed  
**STRU** = number of local units (facilities)

$A_o$  = Accessibility of the municipality of origin in the baseline scenario  
 $\widehat{A}_o$  = Accessibility of the municipality of origin in the project scenario  
 $\alpha^* = 0,961$ , impedance coefficient employed  
 $\beta^* = 0,444$ , impedance coefficient travel time

A measure of **active accessibility** is estimated, which measures the **ease** with which a **user** can **reach opportunities** located in the area. It is evaluated as a **function** of the **number of employed** or the **number of facilities** located in the territory, in relation to the **average travel time**, including entry and exit time, necessary to reach the destination "d", where the employed (or facilities) are concentrated, from all the municipalities of origin "o" belonging to the study area.



### ACCESSIBILITY OF BASIC SERVICES

$$A_o = \sum_d \frac{Add_d^{\alpha}}{T_{0od}^{\beta}}$$

$$\widehat{A}_o = \sum_d \frac{Add_d^{\alpha}}{T_{1od}^{\beta}}$$



### ACCESSIBILITY TO EDUCATION AND CULTURE

$$A_o = \sum_d \frac{STRU_d^{\alpha}}{T_{0od}^{\beta}}$$

$$\widehat{A}_o = \sum_d \frac{STRU_d^{\alpha}}{T_{1od}^{\beta}}$$

For a **synthetic reading of the results**, a **provincial aggregation** was carried out with a weighted average of the resident population in the municipality of origin.

The **% change** represents the **improvement in accessibility** to basic services and to education and culture by province of origin.

(\* Source: *The role of transport accessibility within the spread of the Coronavirus pandemic in Italy*, Armando Cartenì, Luigi Di Francesco, Maria Martino

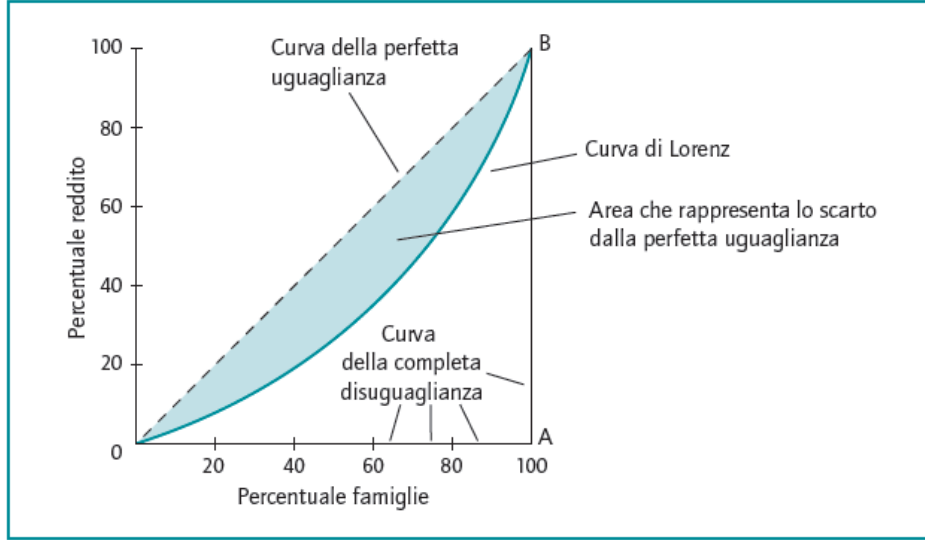


# Contribution to reducing inequality: Gini index

## Methodological note

$qi$  = relative cumulative intensity of the accessibility parameter  
 $pi$  = Cumulative relative frequencies of the municipalities in the study area

In order to estimate a **single synthetic indicator** of the **change in territorial equality**, we have used one of the most widely used measures in the field of socio-economic and transport applications, namely the **Gini concentration index**, which measures the inequality of a distribution.



The Lorenz curve,  $L(x)$ , is a graphical representation of the cumulative distribution of an attribute/quantity in a population, while the Gini index ( $G$ ) is the corresponding measure of the dispersion (inequality) in the distribution of the attribute in a population derived from the Lorenz curve. Graphically, the Gini index is the ratio of the equality line (the bisector of the Cartesian plane) to the Lorenz curve.

**The Gini index takes values between 0 (perfect equality) and 1 (perfect inequality).**

The Gini index thus makes it possible to **represent**, for the same population, **the variation of a given attribute in the face of an intervention**.

The attribute chosen is **accessibility**, measured as described above, which makes it possible to quantify whether the population of the study area has a **more balanced distribution of access to the services** defined by the two indices considered above (Acc. basic services and Acc. education and culture) than the baseline scenario (non-project).

$$G = \frac{\sum_{i=1}^{n-1} (p_i - q_i)}{\sum_{i=1}^{n-1} p_i} = 1 - \sum_{i=1}^{n-1} \frac{q_i}{p_i}$$

# Agglomerative effect

## Methodological note

**H0** = baseline scenario  
**H1** = project Scenario  
 $T_{0od}$  = travel time of baseline scenario  
 $\widehat{T}_{1od}$  = travel time of project scenario  
 $E$  = Employees

Investment in railways reduces travel time, which has an **impact** on **effective employment density**, defined as the level of employment in an area compared to the Generalised Cost of Transport (CGT) required to reach it.

**Effective employment density** is used as a **measure** of the **productivity effects of agglomeration economies**.

Three sources can be identified to explain the **link between firm density and productivity**:

- **technological spillovers**: firms are more likely to adopt innovations from other geographically close firms;
- **input market advantages**: in areas where there is a higher concentration of firms, there is a greater variety of inputs from suppliers.
- **Advantages in labour market**: similarly to the input market, a higher concentration of workers ensures that firms can select workers with specific skills.

**H0**

$$Density_{tj} = \sum_j \frac{E_{tj}}{T_{0tij}}$$

**H1**

$$\widehat{Density}_{tj} = \sum_j \frac{E_{tj}}{\widehat{T}_{1tij}}$$

The **elasticity of productivity to employment density** has been estimated by the British Department for Transport to be 0.04. This means that a 1% increase in employment density leads to a 0.04% increase in productivity.

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# Economic and Employment Impact – Application of Model EIA

## Results

The **economic and employment impact** of this programme of measures is **mainly during the construction phase**. It is assumed that the **annual operating costs** of the railway infrastructure **do not have a significant impact** on the economy and employment.

The **analysis** carried out shows that the **modernisation** of the **railway systems generates Value Added** and **strengthens the employment system**.

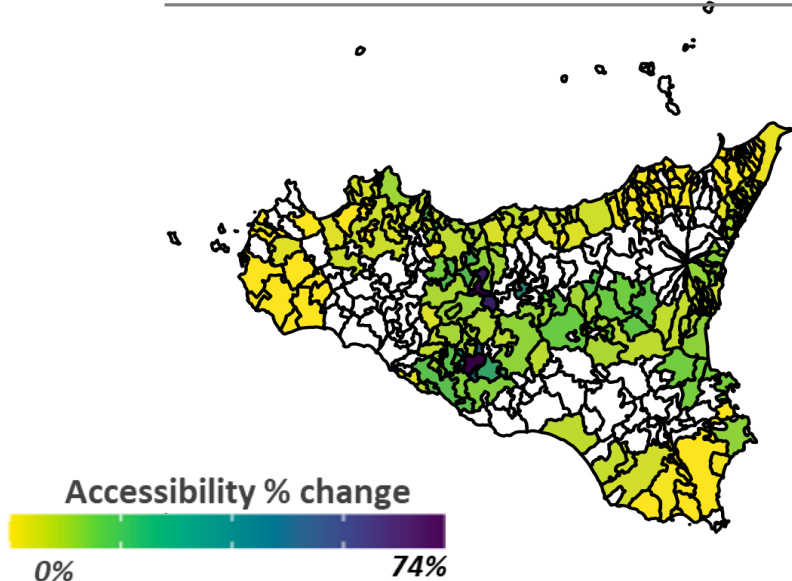
	<b>Value Added</b>	<b>FTE</b>
<b>Impacts</b>	<b>(Mln euro)</b>	<b>(,000)</b>
Direct and indirect impacts	5,384	70
Induced effects	699	13
<b>Total</b>	<b>6,083</b>	<b>83</b>

Taking into account the **direct and indirect effects**, the **value added** is **more than 5 billion**, with a corresponding employment impact of about **70,000 FTE**. Taking a broader view that also **includes induced effects**, the **value added** is estimated at about **6 billion**, with an **employment impact** of more than **80,000 FTE**.

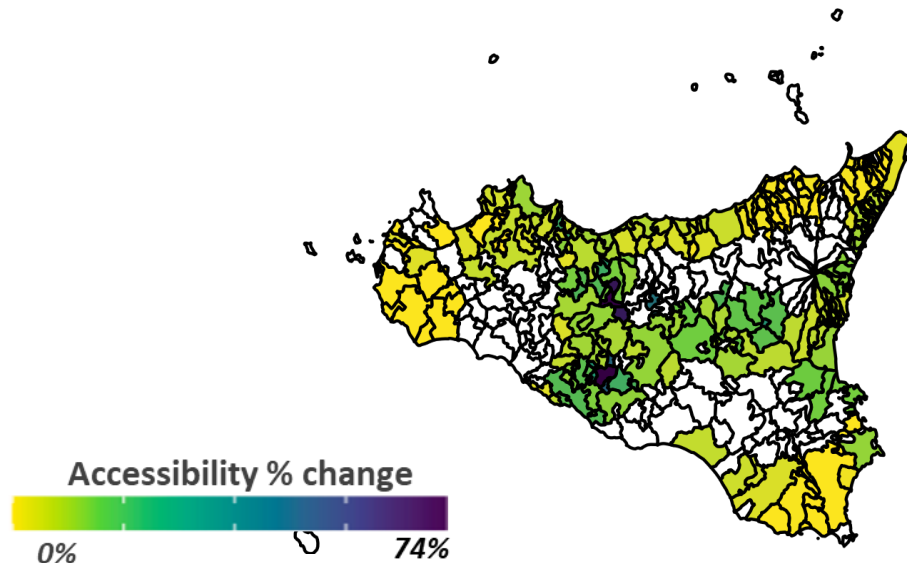
# Accessibility measures

## Graph and main evidence (% change)

ACCESSIBILITY OF BASIC SERVICES



ACCESSIBILITY TO EDUCATION AND CULTURE

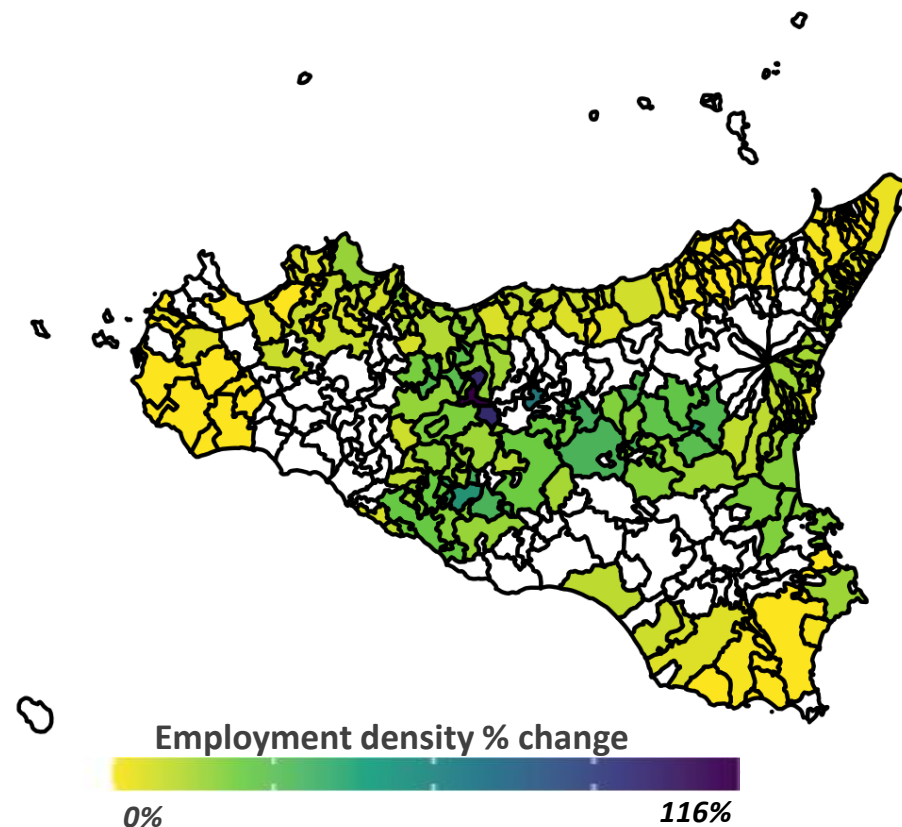


The results of the accessibility calculation show that **Agrigento, Enna and Caltanissetta** are the provinces that will **benefit most** from the investment programme. Although the investment is a **link between two poles**, it also **benefits municipalities in the Sicilian hinterland**. Applying the **Gini index** to the accessibility results in order to **assess the change in inequalities at regional level** brought about by the investment, the result is a **reduction of 0.3%** in terms of **accessibility to basic services** and **0.5%** in terms of **accessibility to education and culture**. This implies a **small contribution** of the investment to the **reduction of territorial disparities** considered in this study.

# Agglomerative effect

## Graph and main evidence (% change)

	EMPLOYMENT DENSITY	PRODUCTIVITY
Caltanissetta	31%	1,2%
Enna	30%	1,2%
Agrigento	23%	0,9%
Catania	13%	0,5%
Palermo	12%	0,5%
Siracusa	10%	0,4%
Messina	4%	0,2%
Ragusa	3%	0,1%
Trapani	1%	0,0%
<b>Total</b>		<b>+5%</b>



The results of the agglomeration effect confirm what has been shown for accessibility, namely that **Enna, Caltanissetta and Agrigento** are the provinces that will **benefit most** from the investment programme. **Since effective employment density is a measure of the impact of agglomeration economies on productivity**, this increase translates into **higher productivity** for those employees in the area.

*Thanks*