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Main long-term policy impacts of the Gotthard base tunnel construction on cross-border land consumption and transformation

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ABSTRACT

The Gotthard transalpine base tunnel is located in Switzerland, it is considered the longest in the world. The purpose of this research is to detect the main effects of long-term policies on the occupation and transformation of cross-border land, in productive, industrial and commercial uses, due to the construction of the Saint Gotthard base tunnel, and the complementary works that enhance it. There are three levels of study proposed, three temporary scenarios (before, during and after the construction) and a comparative analysis with the future Lyon-Turin base tunnel. Maps are made with geodata from Switzerland, Italy and France and interviews with experts by class groups, this was essential to obtain a broader vision of the situation to be analyzed, it is concluded that the use of mixed methods proved to be useful for the stated objectives. A greater displacement of the impact at cross-border levels between Switzerland and Italy is demonstrated, with 43,776.6 ha of productive, industrial and commercial use, in relation to the cross-border areas between Italy and France of 15,593.6 ha related to the Lyon-Turin tunnel. Two types of compensation and empowerment works of the Gotthard System are identified and advantages in formulating long-term articulated policies and well-structured financing processes with participatory mechanisms. This research contributes to the current literature, aimed at researchers and policy-makers on intermodal transport as a response to sustainable logistics.

1. Introduction

The construction of a base tunnel generates irreversible changes, to a large extent public transport and logistics policies are frequently disjointed, they have social opposition groups, displacements or expropriation processes that in many cases are forced, few participatory processes and accountability accounts. On the other hand, the institutional system of the Swiss Confederation seeks territorial coordination and allows consensus on issues that have a strong territorial impact, such as the construction of large transport infrastructures; this at all institutional levels: Federal, Cantonal and Municipal. The relative autonomy at the Cantonal and Municipal levels is also related to coordinating, informing and seeking public participation, consulting (with the possibility of observations) and publishing (with the possibility of appeal) the territorial projects at all levels.

Since 1848 there has been the right to a referendum, the system applied in Switzerland, unlike the Italian or French, is semi-direct democracy that is, the Federal Parliament makes decisions, but the people can always express themselves with the referendum and make

their proposals with a minimum of 100,000 signatures of support.

The Gotthard Base Tunnel was inaugurated on June 1, 2016 and entered into service on December 11, 2016. It took 17 years to build and thousands of workers from around the world. It is considered the longest railway tunnel in the world, to its extension of 57 km (removing this title from the Seikan tunnel in Japan with 53.9 km). The construction cost was approximately 15,000 million euros, which represents 1.83 % of the Swiss annual GDP, and for the execution of the works that enhance the Gotthard system, it was approximately 624 million euros. (Confederazione Svizzera, 2016).

The tunnel connects the cities of Erstfeld in the canton of Uri (to the north) with Bodio in the canton of Ticino (to the south), reducing the transport time of merchandise and passenger traffic by 45 min on the Zurich – Milan route, increasing railway capacity, since the highest point of the Saint Gotthard axis is 550 m above sea level and to cross the Alps they must not overcome large differences in height and significant slopes because this affects the greater consumption of energy, time and transportation costs, facilitating the transit of heavier and longer trains (Fig. 1).

Abbreviations: NFTA, New Transalpine Railway; TEN-T, Trans-European Transport Network; TELT, Tunnel Euralpin Lyon Turin; PIC, Land to productive, industrial and commercial use; TAV, High Speed Train; FFS, Swiss Federal Railways; FS, Italian State Railways; TCNA, Unaccompanied combined transport; TCA, Accompanied combined transport; C4m, Four-meter corridor; TTPCP, Tax on Heavy Vehicles According to Performance.

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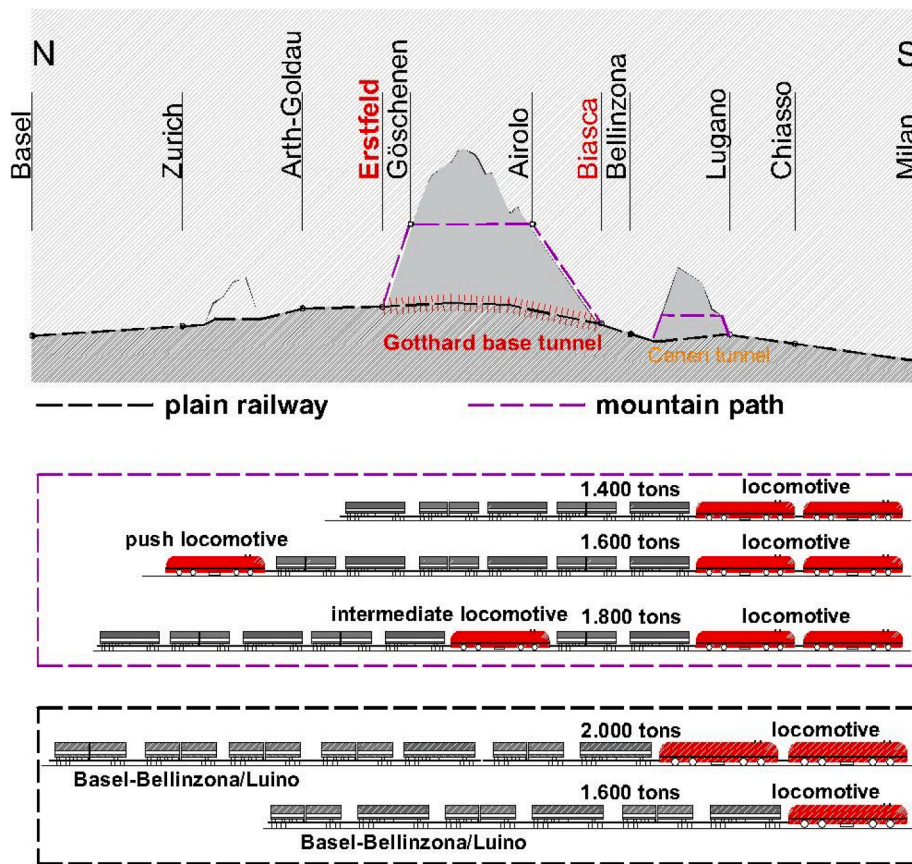


Fig. 1. Difference between the lowland railway route and the Gotthard Mountain route (Source: Author).

This megaproject is part of the New Transalpine Railway (NFTA in original language), approved by popular vote on September 27, 1992, also called *Alptransit*, together with the Lötschberg (34.6 km) and Monte Ceneri (5.4 km) base tunnels. The Gotthard Base Tunnel is a fundamental part of the European Rhine-Alps TEN-T rail freight traffic

corridor that runs from Rotterdam and Zeebrugge in the Netherlands to the Italian city of Genoa. It has a daily capacity of 260 freight trains and 64 passenger trains (UFT, 2019).

On the other hand, the future TAV Lyon-Turin high-speed train line is part of the European TEN-T Mediterranean corridor that joins Algeciras

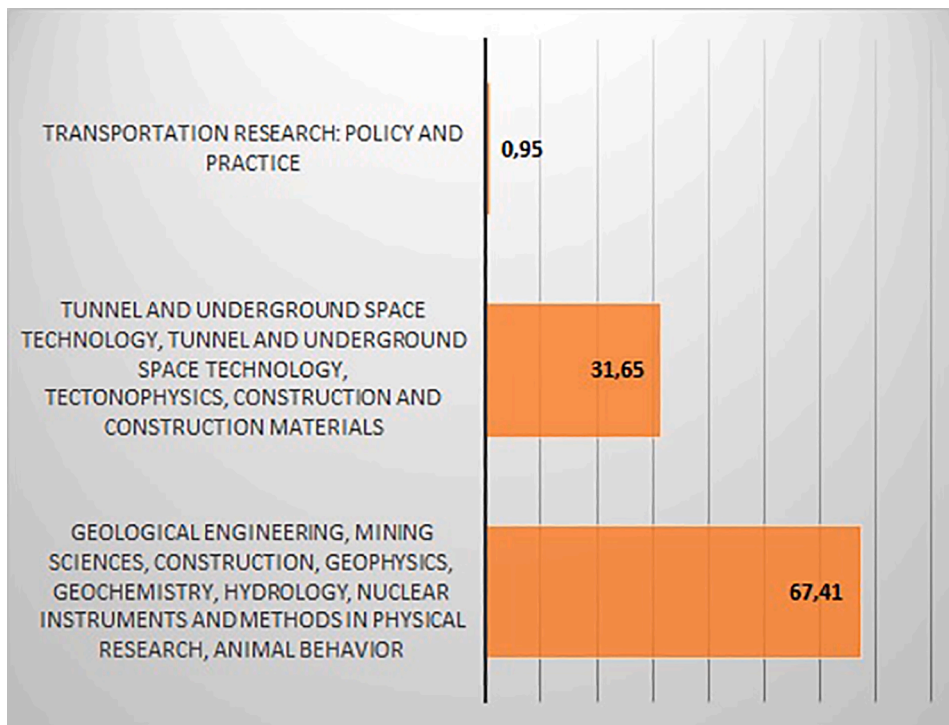


Fig. 2. Phase A: quantitative analysis of articles related to the Gotthard Base Tunnel (Source: Author).

(Spain) with Budapest (Hungary), with an extension of 270 km, of which 30 % is located in Italy and the rest in France, The company in charge of the construction is TELT-Tunnel Euralpin Lyon Turin (incorporated on February 23, 2015), made up of 50 % of the French Ministry of Economy and the other 50 % of the Italian State railways, with a management mandate of 99 years (TELT, 2018). The construction of this important infrastructure has been immersed in debates against the project, with countless protests rejecting the construction.

The general objective of the research is to compare the transalpine transport policies, before, during, and after the construction of the Saint Gotthard base tunnel with the policies applied for the construction of the future TAV Lyon-Turin railway line and thus be able to measure the impacts in the occupation and transformation of the land according to three proposed levels of analysis. Therefore, the research question is: How does the construction of the Gotthard Base Tunnel impact the occupation and transformation of the land to productive, industrial and commercial use (PIC) according to three proposed levels of analysis, when compared to the base tunnel the future TAV Lyon-Turin railway line and what relationship do long-term transalpine cross-border

transport policies have with respect to short-term ones in the effects detected?

There are two research hypotheses:

1. Long-term transalpine transport policies have a greater impact than short-term policies on territorial dynamics by building the Gotthard base tunnel in relation to the Zürich-Milan metropolitan axis.
2. Land occupation by productive, industrial and commercial use (PIC) and the projects of the Gotthard system of axis 2 will be significantly higher compared to axis 1, influenced by the participatory public policies applied in the long term when building the Saint Gotthard base tunnel.

After the introduction, the document is structured as follows. Section 2 literature reviewed. Section 3 presents the methodology through a comparative analysis. Section 4 corresponds to the results and discussion about public policies, treaties and conventions for the construction of the Gotthard tunnel, the relevance of the impacts caused by long-term policies in the Swiss railway system and conclusions of the class groups

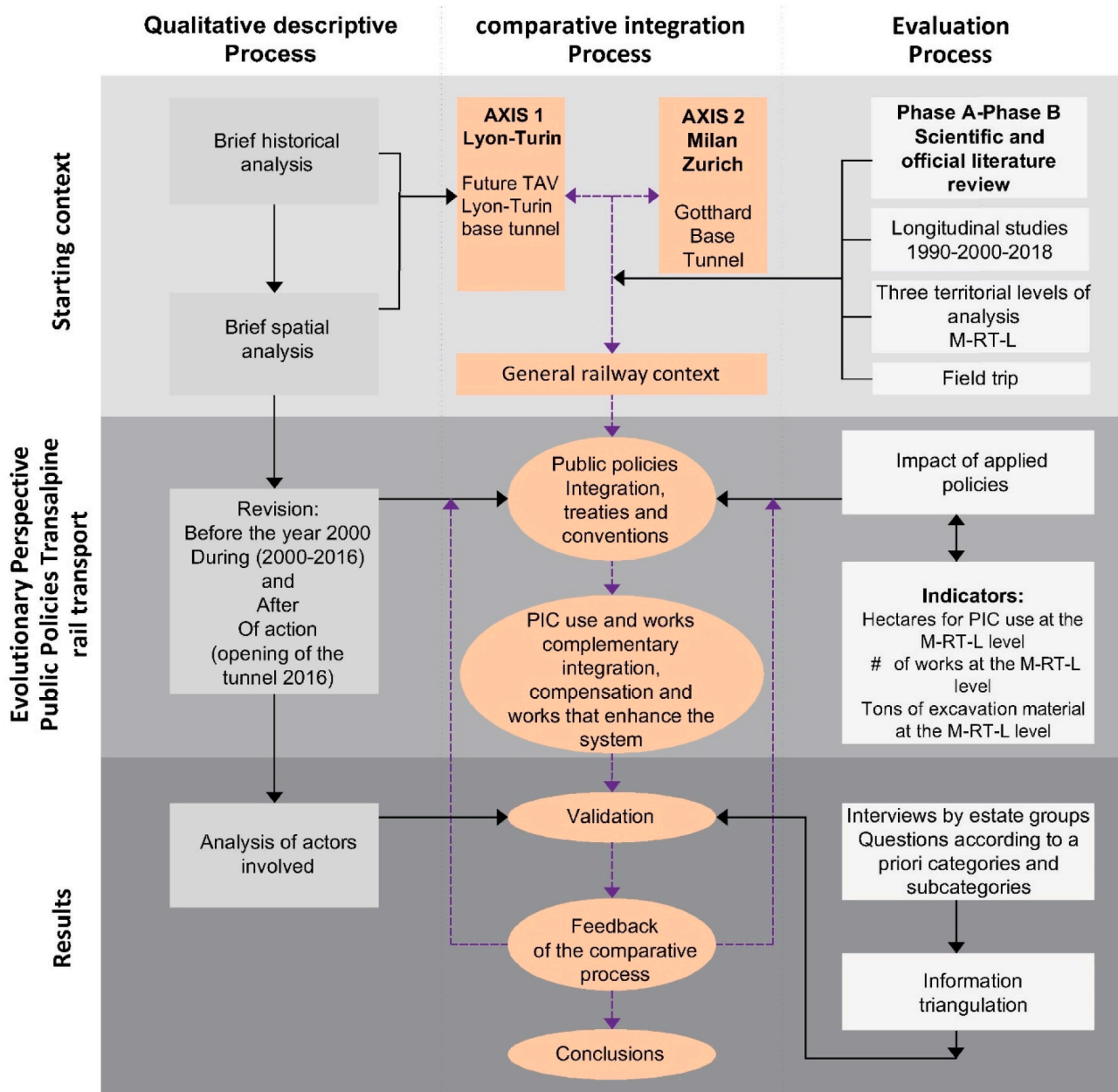


Fig. 3. Scheme of the methodology used (Source: Author).

interviews. Section 5 corresponds to the general conclusions of the investigation.

2. Literature reviewed

The framework is developed in two phases. Phase A is a quantitative analysis, 316 research articles were found, but only 0.95 % were on policy and practice issues, the rest were on technology, geology, engineering or geophysics issues as shown in Fig. 2. The search was in Science Direct, in English and as “Gotthard Base Tunnel” and only “Research articles”. Of the three articles related to policy and practice, one presents a competition model of freight transport between road and rail in the Swiss Alps, the other analyzes travel demand and its distribution with origin–destination matrices for a Swiss national model, and the last article presents VA railway indices of spatial and social equity for northern Italy.

Phase B corresponds to a qualitative analysis, whether from scientific or official sources, the literature on the reuse of excavation material and its use in transforming the soil in urban and transportation projects was limited, however an article was found on the governance of the 3 transalpine TEN-T corridors, related to financing and economic efficiency for pricing and economic exchange (import–export), which analyzes policies from the period 2000 to 2014 (Baccelli & Barontini, 2014). Another study analyzes the impact of AlpTransit in the canton of Ticino, based on three criteria: traffic, the economy (increase in tourist attraction) and the development of settlements (new residential/industrial/commercial areas), these in turn are based in the *Tripod* analysis model that analyzes the direct and indirect territorial effects caused by transport infrastructures (Testuri, 2009).

The closest study to this research makes a political-institutional comparison of the Frejus tunnels (Future TAV Turin-Lyon) and the Gotthard, concentrating on the Frejus conflict and comparing it with the Gotthard, makes a technical and political-institutional framework of the two cases and a discussion about the construction process of both tunnels (Marletto, 2011). It does not analyze any type of impact of long-term policies on the consumption and transformation of transboundary land like this research. For this reason, it is considered that this document can be an important contribution and fill this gap.

In the search for official documentation, the Gotthard Axis Monitoring Program (MAG in original language) was found developed by the Swiss Confederation was very useful in the general context and methodology, but distant from the objectives of this research. The main objectives of the MAG are: to observe changes in freight and passenger traffic. Observing effects on territorial development in relation to the economy, settlements, environment and landscape, considering the territorial levels (region, corridor and areas around railway stations), is subdivided into three phases: A ex-ante (2015–2017), B ex-post (2020–2023) and C (2025–2027) (ARE, 2021).

The impact is “the difference between what would happen with the action and what would happen without it” (AIAI, 2009, p. 1). This difference is analyzed, which shows the “incidence that transport infrastructures (and their operation) have in the territory” (Díaz & Ureña, 2010, p. 31) and its impact on the occupation and transformation of the land when applying different public policies to the construction of the Gotthard Base Tunnel.

The occupation and transformation of the land are related to the consumption of the parcel of territory. According to the Italian research institute ISPRA, land consumption is defined as “a variation from non-artificial land cover (non-consumed soil) to artificial land cover (consumed soil)” (ISPRA, 2016, p. 12). This variation is related to territorial dynamics, land consumption is considered as the increase in artificial land cover, “due to the occupation of surfaces that were originally for agricultural, natural or semi-natural use” (ISPRA, 2016, p. 12).

Land cover refers to the “physical and biological cover of the earth’s surface that includes artificial surfaces, agricultural areas, forests, (semi) natural areas, wetlands and water bodies” (Parlamento Europeo, 2007,

p. 12). Fundamental concepts that will allow an approach to identify the “reflection of the interactions between human beings and the land cover” (ISPRA, 2016, p. 12) for the implementation of public policies in the long, medium and short term.

3. Methodology

This is an empirical research that seeks a balance between quantitative and qualitative methods through a comparative analysis, based on three levels: starting context, evolutionary perspective in transalpine rail transport policies and results (Fig. 3). Considering the point of view of the quantitative researcher, it is analyzed in an objective and neutral way, whereas as a qualitative researcher, an attempt is made to immerse oneself in reality, creating a relationship of empathy for a greater understanding of the subject (Corbetta, 2007). Longitudinal studies are proposed at the time of collecting quantitative information, three temporary moments were detected, with the *objective* “of analyzing changes or continuity in the characteristics” (Bisquera et al., 2004, p. 199).

To delimit and organize the comparative study, two territorial axes are proposed, axis 1: Lyon-Turin and axis 2: Milan-Zurich. It is divided into three phases, the first is the comparison of public policies for the construction of the Saint Gotthard base tunnel, with the future base tunnel of the cross-border section between Susa-Bussoleno and Saint Jean de Maurienne of the TAV Turin-Lyon. Longitudinal studies are proposed in three temporary spaces, before the action, that is, before the year 2000, during the action, and after the action, which corresponds to after the year 2016, the action considers the construction of the Gotthard tunnel (from 2000 to 2016).

The second phase makes maps with geodata (shapefile), which help to quantify in hectares, the occupation of land for PIC use and transformation of the land by works that enhance the Gotthard system, at three identified levels of analysis:

- Metropolitan level (M): Axis 1: Lyon-Turin and Axis 2: Milan-Zurich.
- Cross-border regional level (RT): in Italian territory on axis 1: Turin-Bussoleno-Susa-Salbertrand-Bardonecchia and on axis 2: Mendrisio-Stabio-Arcisate-Varese-Gallarate.
- Local level (L): axis 1 goes from Susa-Italy to Saint Jean de Maurienne-France and axis 2 comprises the cities that go from Erstfeld to Bodio and the Canton of Ticino, Uri and Grigioni in Switzerland.

The reference years for the maps are the year 1990 as before the action, 2000 during the action and the year 2018 as after the action, a deficit in unified information from region to region is detected, for this reason sources are chosen at European level. Since Switzerland is not part of the EU, no information was found for the year 1990. An attempt was made through the Swiss Federal Office of Topography, Statistics and the technical office of the Canton of Ticino without success, since they do not classify in the same way the land use, as they do in Italy and France. The current *Registro federale degli edifici e delle abitazioni* (Federal Register of Buildings and Housing – REA) does not identify PIC use individually, but rather they are part of the category: Buildings for non-residential use GKAT 1060, which groups buildings for educational use, cult, sports, industrial, administrative, commercial, wineries, agricultural (UST, 2019).

The source for making the maps for the year 1990 is from the CORINE Land Cover project, directed by the European Environment Agency, the link is: <https://land.copernicus.eu/pan-european/corine-land-cover>. For the maps of the year 2000 and 2018, the Geofabrik server was used with data extracted from the OpenStreetMap world project that collects geographic data, the link is: <https://download.geofabrik.de/>. The management of the geodata took longer than expected, since it is heavy and takes several days to load the data (Appendix Table A.1).

To finish, a triangulation of the information and interviews by class groups was carried out, the questions were related to the a priori

Table 1
Identification of a priori categories and subcategories (Source: Author).

General objective	Specific objectives	A priori categories	Subcategories	
To compare the transalpine transport policies applied before, during and after the construction of the San Gottardo base tunnel with the policies applied for the construction of the future TAV Turin-Lyon railway line and thus be able to measure the impacts on the occupation and transformation of the land according to three levels of proposed analysis.	* Describe transalpine transport policies before, during and after (period 1869–2020) the construction of the San Gottardo base tunnel and determine their relevance in relation to outcome variables.	Alpine politics	* Construction of the San Gottardo Base Tunnel * Railway infrastructure financing instrument * Instruments of public debate for the construction of large infrastructures * Cross-border rail policies	
	* Compare the cross-border railway policies and measures taken by the governments of Italy, Switzerland and France and determine the importance of long-term policies in relation to short-term policies.	Long-term and short-term policy efficiency		
	* Identify the subsidized and non-subsidized infrastructure works, before, during and after the construction of the Gotthard by international agreements of the two axes of study according to three levels of proposed comparative analysis.	Potentialization of the Gotthardo System		* Complementary Work * Work that empower the tunnel * Compensation works
	* Measure the occupation of the land for PIC use in the years 1990 and 2018 of the two study axes according to three levels of comparative analysis through maps with geodata and determine the concordance of their results.	Land occupation for PIC use		* Difference in hectares of PIC use between axes 1 and 2.

categories and subcategories raised (Table 1), “thus constituting the organic expression that guides and directs the construction of the information gathering instruments” (Cisterna Cabrera, 2005, p. 65). All interviewees agreed to sign a letter of authorization to be able to disclose data from the interviewee and information collected for academic purposes. The class groups correspond to: A experts, such as intermodal transport companies and academics; B public administrators with elected political figure; and C to technical officials of public entities (Table 2).

4. Results and discussion

Since 1869, a system of connection between strategic points that make up the current Gotthard System had already been planned, which

Table 2
List of interviewees by class groups (Source: Author).

GROUP A Intermodal Transport Companies and Scholars	GROUP B Public Administrators with Elected Political Figure	GROUP C Technical Officials of Public Entities
A1. Professor Olivier Bacceli. Professor of Economics and Politics of passenger and freight transport. Bocconi University of Milan, Italy.	B1. Dr. Eng. Fabio Sai Advisor to Roads, Urban Planning, Private Construction, Public Works and Environment. B1. Franca Valeria Squitieri Counselor on issues: rail transport, circulation plan and urban mobility. Municipality of Luino, Prefecture of the Province of Varese, Italy.	C1. Eng. Giorgio Stagni Director of the Railway Service of the Lombardia Region, Italy.
A2. Dr. Francesco Russo Head of customer service and customs services at Hupac, an intermodal transport company, Busto Arsizio-Gallarate, Italy.	B2. Dr. Bruno Arrigoni Mayor of Chiasso, Canton Ticino, Swiss Confederation.	C2. Arq. Marta Cundari Sector 4 Director. Municipality of Gallarate, Italy.
A3. Professor Gian Paolo Torricelli Territorial Observation Laboratory (OST). Accademia di architettura (USI) in Mendrisio, Swiss Confederation.	B3. Dr. Stefano Imelli Mayor Bodio Municipality, Swiss Confederation.	C3. Dr. Aurelio Viganì Since 2014 head of Scientific Project, DATEC-ARE transport section. Swiss Confederation. Responsible for the MAG Monitoraggio Asse San Gottardo project (Phase A, B, C; 2015–2028) Representative member for Switzerland of the Mobility EUSALP working group C4. Eng. Martino Colombo Territorial Development and Mobility Division, Canton Ticino, Swiss Confederation. C5. Dr. Diego Rossi, Transportation Sector Eng. Luca Cremona, Road Sector Prefecture of the Province of Varese, Italy. C6. Arch. PhD. Alex Sollero Scientific collaborator of the Department of the Territory - Territorial Development Section DATEC - ARE. Swiss Confederation. C7. Eng. Stefania Iachella Arq. Marco Novelli General Management of Infrastructure and Mobility of the Lombardia Region, Italy

regulated the police services, tolls and the construction of the international station of Luino in Italy. It is more than one hundred and fifty years that a continuous process of analysis, evaluations, considerations and improvements has been generated, which has resulted in the construction of the longest base tunnel in the world.

4.1. Public policies, treaties and conventions for the construction of the Gotthard base tunnel (before, during and after)

Each of the following policies, agreements, treaties or conventions respond to parameters established by the Swiss federal constitution, as it is the one with the highest normative hierarchy. Next, the three constitutions related to the subject of study of Switzerland, France and Italy

are compared.

From the current federal constitution of Switzerland, which replaced the one of May 29, 1874 with popular vote on April 18, 1999, enters into force on January 1, 2000, the main information is extracted from articles 84, 85, 87, 130 and 196 related to the subject of study ([Confederazione Svizzera, 1999c](#)):

- Art. 84 Alpine transit (with temporary provision). It seeks to protect the alpine region from vehicular traffic. The transport of merchandise through the Alpine region is by rail. The capacity of alpine roads cannot be increased.
- Art. 85 Tax for heavy traffic (with transitory provision and accepted by popular vote on February 9, 2014). The Confederation can apply taxes to heavy traffic measured according to service and consumption. The net product of the tax is used to cover the costs of land transport and a part of the net product is transferred to the funds of each Swiss canton in relation to the obtained repercussions.
- Art. 87 Railway infrastructure (with transitory provision and accepted by popular vote on February 9, 2014). Most of the financing of the railway infrastructures is by the Confederation, through a fund that comes from no more than two thirds of the proceeds from heavy traffic taxes, 2 % of federal tax revenues in relation to revenue from natural persons and from the general annual budget of the Confederation of 2,300 million Swiss francs.
- Art. 130 Value Added Tax - VAT (with transitory provision). Rates increase by 0.1 percentage points to finance railway infrastructure, accepted by popular vote on February 9, 2014.
- Art. 196. Temporary provisions according to the decree of December 18, 1998. Art. 84: with a maximum term of 10 years from the moment the popular initiative was accepted. Art. 85: for Swiss and foreign motor vehicles and trailers weighing more than 3.5 t. Art. 87, 87a.: The construction phases of the project of the new transalpine railway (NFTA) are integrated into the federal law, prior approval of the federal council of deadlines and work stages. Art. 130: Expiration at the end of 2020, but to guarantee financing, the Federal Council, on January 1, 2018, approves an extension with a maximum date of December 31, 2030. The Federal Council increases rates by 0.1 percentage points of VAT. (June 20, 2013)

It is interesting how the Swiss constitution according to art. 84 radically influences, not only the transit of merchandise traffic in its territory, but even in Italy or who transits from abroad, since they must consider frequencies, infrastructures, costs, taxes, etc., to be able to transit their merchandise through the Swiss territory and later through the different European corridors.

The Swiss constitution proves to be very specific, indicating tax rates for heavy traffic (from 3.5 t to over 26 t), classified in trucks, trailers and articulated vehicles, provisions that do not appear in all constitutions. Regulates and favors the transalpine transport (Basilese region, Altopiano, central Switzerland and Ticino) of merchandise by rail and not by road, giving time for the transfer (art. 84), contributes to reducing environmental and noise pollution, improving living spaces, as well as limiting the capacity of transit roads in the Alpine region, which has been going on since 1994.

The Parliament materializes article 84 of the constitution in a law to transfer merchandise traffic from road to rail across the Alps, setting a maximum passage of 650,000 trucks until 2018, in recent years after the inauguration of the Gotthard base tunnel (2016) the number has decreased, but it still does not reach the set goal, in 2019 there were 898,000, if it is considered that in 2001 there were 1.4 million there was a decrease of 36 % ([DATEC, 2019](#)).

On the other hand, the French and Italian constitutions outline general guiding principles, constitutional values, which are the foundation for the legal and political ordering of society, establish structures for the organization and functioning of the state and the different branches of public order. The two constitutions do not describe with as much detail

and precision the delineations regarding transalpine transport issues, rates, deadlines, financing modalities and rail transport of passengers and merchandise as does the constitution of the Swiss confederation.

In the French constitution of October 4, 1958, the closest thing to the topics of interest, includes the protection of the environment defined in the *Charte de l'environnement of 2004* (Environmental charter), declaring to guarantee sustainable development and preservation without mentioning the topics of interest ([Conseil Constitutionnel Français, 2015](#)). The Italian constitution of 1947, refers to the protection of the environment and the ecosystem, in the section of economic relations establishes the favor of international agreements and with the European Union as well as the French in general, without specifying the issues of interest ([Senato della Repubblica italiana, 2017](#)).

4.1.1. Before, during and after the construction of the Saint Gotthard base tunnel

The treaties and conventions corresponding to the Gotthard railway date back to the middle of the 19th century, a total of 23 were identified ([Table 3](#)) and the following are mentioned among the main ones:

- October 15, 1869. Convention between Italy and Switzerland. Construction and operation of the railway through the Gotthard, the conjunction of the Swiss railway network with the Italian, of international stations and the need to nominate plenipotentiaries. Priority of the Lugano-Chiasso sections in Switzerland and Chiasso-Camerlata in Italy ([Confederazione Svizzera, 1873](#))
- December 23, 1873. Treaty between Italy and Switzerland for the junction between the Saint Gotthard railway with the Italian railway network, between Chiasso and Pino. The construction of the international stations of the border cities in Chiasso (Switzerland) and in Luino (Italy), as part of the lines Bellinzona-Chiasso-Camerlata and Bellinzona-Pino-Luino respectively ([Confederazione Svizzera, 1873](#)).
- October 13, 1909. International convention between Switzerland, Germany and Italy. On the Lucerne-Immensee-Arth Goldau-Giubiasco-Chiasso, Zug-Arth Goldau, Giubiasco-Cadenazzo-Pino border and Cadenazzo-Locarno lines. Different rates are set for passenger traffic, and a surcharge of 50 % for sections with a slope greater than 15 % ([Confederazione Svizzera, 1909](#)).
- May 11, 1982: agreement between the Swiss Confederation and the Italian Republic, between the Swiss Federal Railways (FFS in original language) and the Italian State Railways (FS in original language), for the construction of a new double track railway line (8 km long approx). The Swiss Confederation undertakes to finance the construction of this railway tunnel with 60 million Swiss francs, 40 million as a non-reimbursable fund and 20 million as a loan in favor of the Italian Republic ([Confederazione Svizzera, 1982](#)).
- October 7, 1993. Federal Law on Environmental Protection (LPAMB in original language). It mainly focuses on generating waste recycling and the development of clean technology ([Confederazione Svizzera, 1983](#))
- October 4, 1991. Federal law concerning the construction of a transalpine railway, the New Transalpine Railway - NFTA program is proposed ([Confederazione Svizzera, 1991](#)).
- February 20, 1994. By popular vote, the Swiss cantons declare their willingness to transfer heavy goods traffic across the Alps from road to rail. ([Confederazione Svizzera, 2019](#)). Transforming into a “particularly ambitious railway network development program, which aims to respond to the need for a strong mitigation of the environmental and economic effects derived from excessive dependence on road transport” ([Baccelli & Barontini, 2014, p. 9](#)).
- June 17, 1994. Federal Law on Road Traffic in the Alpine Region (LTS in original language), in the Gotthard. It is established that the capacity of the roads cannot be increased, the construction of new roads is limited, nor can the existing ones be widened ([Confederazione Svizzera, 1994](#)).

Table 3

Public policies, treaties and conventions for the construction of the Gotthard Base Tunnel (before, during and after) (Source: Author).

Long-term policies	Medium-term policies	Short-term policies
<p>Before the year 2000</p> <p>1869 Switzerland-Italy Conjunction of the Swiss railway network with the Italian priority sections Lugano-Chiasso / Chiasso-Camerlata</p> <p>1873 Switzerland-Italy Construction of the Chiasso (Switzerland) and Luino (Italy) international stations</p> <p>1879 Switzerland-Italy Special subsidy for Bellinzona-Pino / Lugano-Chiasso lines</p> <p>1881 Switzerland-Italy Police Service of the Chiasso and Luino International Stations</p> <p>1882 Switzerland-Italy Chiasso and Luino stations toll service</p> <p>1909 Switzerland-Germany-Italy Switzerland guarantees the uninterrupted service of the Gotthard railway, fare advantages for passengers and merchandise</p> <p>1982 Switzerland-Italy Partial financing in favor of Italy by the Confederation. New double track railway line between Chiasso (Switzerland) and Albate-Camerlata (Italy)</p> <p>1983 LPAmb-814.01 /Modified in 1993 Federal law for the protection of the environment</p> <p>1991 Switzerland Federal law concerning the construction of a transalpine railway - LTAlp/NFTA.</p> <p>1994 Switzerland Transfer of transalpine freight traffic from road to rail</p> <p>1997 Switzerland LTTP heavy traffic law</p> <p>March 1998 Switzerland Decree program NFTA</p> <p>September 1998 Switzerland Tax on trucks, trailers and articulated vehicles weighing more than 3.5 t.</p> <p>April 1999 Switzerland Amendment to the Federal Constitution of the Swiss Confederation on alpine traffic</p> <p>June 1999 Switzerland-European Union Coordinated freight and passenger transport policy, associating the efficiency of transport systems, increasing the capacity of access roads to the NFTA from north to south</p> <p>October 1999 Switzerland Federal law to transfer transalpine freight transport from road to rail. Objective 650,000 annual road trips</p> <p>November 1999 Switzerland-Italy Guarantee the connection capacity between NFTA and RAC, rationalization of railway lines and rolling interoperability. Adapt the gauges of the Lötschberg/Sempione-Milan axes</p>	<p>During the years 2000–2016</p> <p>2000 Switzerland Reimbursement of the additional costs generated by the use of the Railway Highway services until 2018 and TCNA for the years 2011–2023</p> <p>March 2000 Ordinance for heavy traffic tax commensurate with TTCP benefits who pollutes pays</p> <p>2008 Switzerland LTransf contributes to achieving the 2018 transfer target of 650,000 trips/year for road freight transport Intermediate objective year 2011 max. 1,000,000 trans.alpine trips/year</p> <p>2012 Switzerland-Italy Transport capacity 2000 t., width PC80, train module length 750 m</p> <p>2013–2016 Switzerland Federal Law of the Fund to finance the railway infrastructure - FIF, destined to maintain the quality, renovation, expansion and modernization of the railway infrastructure</p> <p>2014 Switzerland-Italy €120 million for the 4 m corridor, access to the NFTA, line from Luino, Gallarate, Novara (Italy), €80 million non-reimbursable Swiss funds</p> <p>2015 OPSR-814.600 Ordinance for the prevention and disposal of waste from the construction of large infrastructure projects. Art.19 and annex 3.</p>	<p>After the year 2016</p> <p>2017 Italy Ferrobonus. Economic incentive for companies that offer to increase the intermodal rail transport service</p> <p>2019 Switzerland Decree that increases the TACNA compensation and extends it for the 2024–2026 period, 83 million euros approx. (90 million swiss francs)</p>

- December 19, 1997. Federal law concerning the heavy traffic tax according to performance (LTTP in original language), the tax is used in a third of the net income to the cantons as a related expense (according to the length of the road network, population, taxes to the vehicles) and two thirds to the Swiss Confederation, which will be used to finance large railway projects according to a transitory provision. The rate goes from 0.6 ¢/tkm to 3 ¢/tkm, with a maximum total weight of 40 t ([Confederazione Svizzera, 1997](#)).
- March 20, 1998. Federal decree concerning the construction of the transalpine railway, seeking to integrate unaccompanied combined transport (TCNA in original language) to the European railway corridors ([Confederazione Svizzera, 1998](#)).
- September 27, 1998. Tax on trucks, trailers and articulated vehicles weighing more than 3.5 tons that circulate on Swiss roads, must pay the heavy traffic tax according to performance (origin of the future TTCP), according to the weight, the emission of harmful substances and according to the kilometers traveled ([DATEC, 2019](#)).
- June 21, 1999. Agreement between the Swiss Confederation and the European Community, seeks to facilitate the transport of passengers and goods by road and rail, technically, economically and geographically more appropriate and establish the necessary modality to generate a coordinated transport policy, associating the efficiency of transport systems and guaranteeing sustainable mobility. The maximum authorized weight for articulated vehicles and freight trains is 34 tons and not more than 40 tons. The new infrastructures will be built with UIC-C gauge. Promote combined transportation; respect the technical and social standards for road transport such as driving time and rest, among others ([Confederazione Svizzera, 1999a](#)).
- October 8, 1999. Federal law related to transferring the transport of goods from road to rail across the Alps, proposes not to exceed 650,000 annual trips by road to transport goods across the Alps ([Confederazione Svizzera, 1999d](#)).
- November 2, 1999: agreement between the Federal Department of the Environment and Transport (DATEC) and the Ministry of Transport

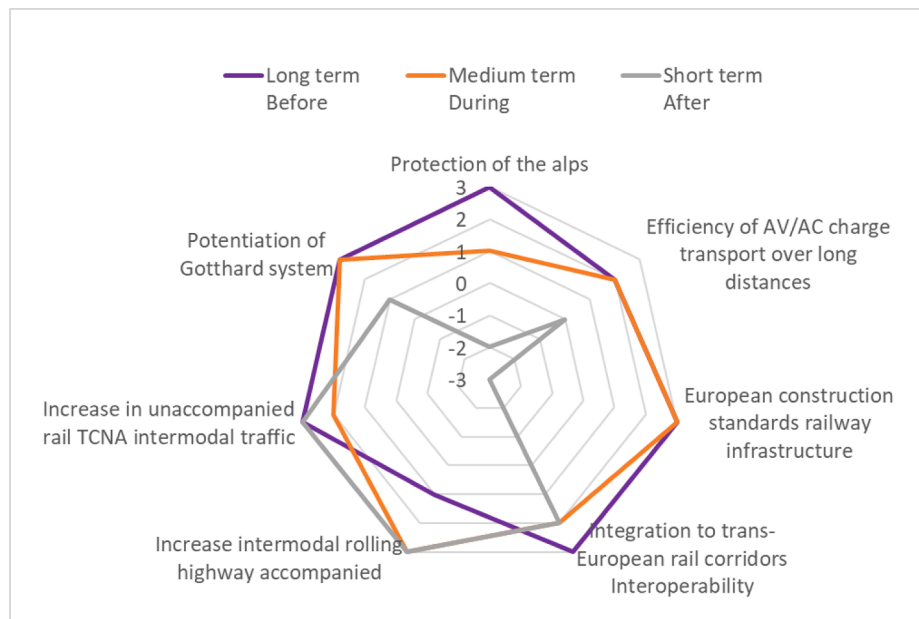


Fig. 4. Relevance of the impact of Swiss policies for the construction of the Gotthard Base Tunnel (Source: Author).

and Navigation of the Italian Republic, related to the guarantee of the capacity of the main lines that connect to the new Swiss transalpine railway (NFTA) with the Italian high-capacity network (RAC in original language). It seeks to improve the railway connections of the Italian regions of Milan, Novara and Genoa and the Swiss regions of Zurich, Geneva, Lausanne, Basel and Bern, specifically the lines Zurich-Saint Gotthard-Milan and Zurich-Sian Gotthard-Novara-Genoa. The application of certain measures and procedures is specified, in the short term, such as adapting the gauges of the Lötschberg/Sempione–Milan and Saint Gotthard–Novara axes, whereas in the medium and long term, optimizing the connections with the Milan Malpensa airport (Italy), increase capacity and improve travel time on the Saint Gotthard–Milan and Saint Gotthard–Novara routes. Also, the optimization of existing terminals and/or the creation of additional terminals for combined accompanied (TCA in original language) and unaccompanied transalpine transport (TCNA in original language). The financing of railway infrastructures could be with public–private partnership in a coordinated manner (Confederazione Svizzera, 1999b)

During the construction of the Gotthard Base Tunnel (year 2000–2016), only three laws and two intergovernmental agreements were detected (Table 3). These are related to compensating the different cost overruns of the railway companies and operators of accompanied combined transport (TCA-rail highway) until 2018 and of unaccompanied combined transport (TCNA) from 2011 to 2023, due to the inefficient service of the historical railway lines. (gauge, traction costs due to the need for a second or third locomotive), with a spending limit of 1,675 million francs by 2019, which are part of the freight transport subsidy for the transalpine railway and cover in some way operating losses (Baccelli & Barontini, 2014).

On March 6, 2000, Ordinance for heavy traffic tax commensurate with benefits (TTPCP in original language), based on the principle of who pollutes pays (Confederazione Svizzera, 2000). It must be paid for all cargo vehicles that transport goods over 3.5 t. that circulate on the Swiss road network and the Principality of Liechtenstein, depends on the kilometers travelled, the level of emissions and the total weight of the vehicle. For vehicles with trips in TCNA, transportation of animals for rent, raw wood or bulk milk, different reimbursements and concessions are provided (Confederazione Svizzera, 2020).

In 2012, a train module length of 740–750 m was specified in order

to comply with European standards until 2020 (Confederazione Svizzera, 2014). In 2014, the financing modality for the execution of the 4 m corridor was defined, in the access routes to the NFTA in Switzerland, allowing southern access to transit cargo trains of up to four meters in height. Of 120 million euros as a subsidy, 80 from Swiss funds and 40 from Italian funds, giving priority to work on the Luino line (Italy), on the railway section between the Swiss border, Gallarate (Via Laveno-Sesto Calende/Besozzo) and Novara (via Sesto Calende). These actions help avoid traffic jams and enhance the Gotthard system (Confederazione Svizzera, 2014).

After the construction of the Saint Gotthard base tunnel (2016), only two decrees were found (Table 3), the one from 2017 with the *Ferrobonus*, which is an economic incentive aimed at companies that offer the intermodal rail transport service (without load breakage) and/or transshipment (with load breakage) and combined transport operators, who order complete trains (train purchased in full capacity from a single customer) from railway companies and undertake to maintain traffic volumes at in terms of trains per kilometer and to increase them during the incentive period (MIT, 2017).

4.1.2. Main agreements between France and Italy for the construction of the future Lyon-Turin base tunnel between Saint-Jean-de-Maurienne (France) and Susa-Bussoleno (Italy).

Before the 1996 agreement (Paris), which defined the formation of the Italian-French Intergovernmental Commission that will be in charge of the construction of the new railway line between Turin and Lyon, several summits and bilateral meetings were held among the representatives of the Italian and French Government who contributed to the different agreements, made in 1951, 1990, 1991, 1992, 1993 and 1994, there are later those of 2001, 2011, 2012, 2015 and 2016.

In general, they are summits, protocols and agreements that seek to carry out feasibility studies, preliminary functional studies, approval of the route or define the estimated costs of the project, customs police and security control protocols were also found. Some agreements also define the start date of the works, the international section, equipment and railway infrastructure necessary for the construction of the new line, it is not about articulated rail transport public policies or long-term support that guarantee the correct operation at the conclusion of the work, as in the case of the Gotthard.

It should be considered that, in French territory, the project is submitted twice to participatory evaluation processes, while in Italy it is

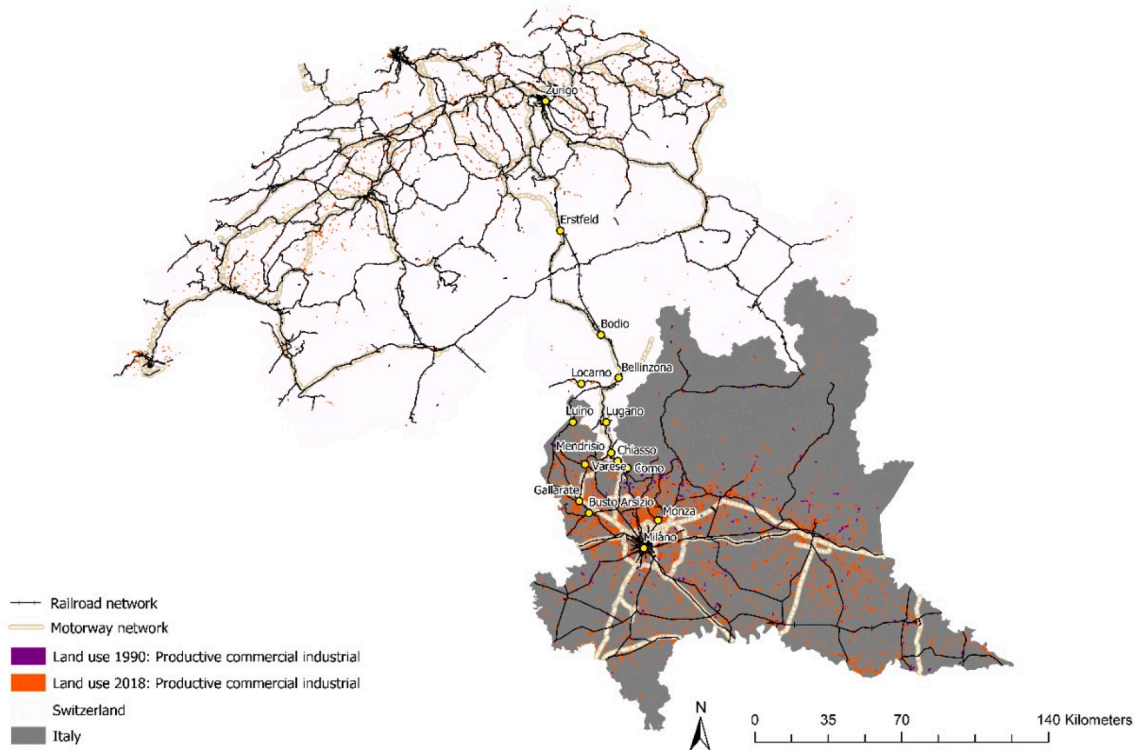


Fig. 5. Difference in the occupation of productive, industrial and commercial land use-PIC. Years 1990 and 2018. Axis 2 Milan-Zurich (Source: Author).

considered as strategic works of the *Legge obiettivo* (Objective Law), avoiding “thus the ordinary administrative steps (...). An attempt is made to remedy this imbalance with the Observatory of the Turin-Lyon railway line (...) there is insufficient independence - the observatory is directed by Mario Virano who is at the same time a government Commissioner” (Marletto, 2011, p. 77), responsible of carrying out the work. The work is carried out without taking into account the *Accordo di*

Pracatinat, in which disagreements are indicated in relation to phases and times of completion of the work, further aggravating the situation of protest and disagreements (Marletto, 2011).

4.1.3. Relevance of the impacts caused by long, medium and short term policies in the Swiss railway system

The relevance of the main public policies mentioned above are

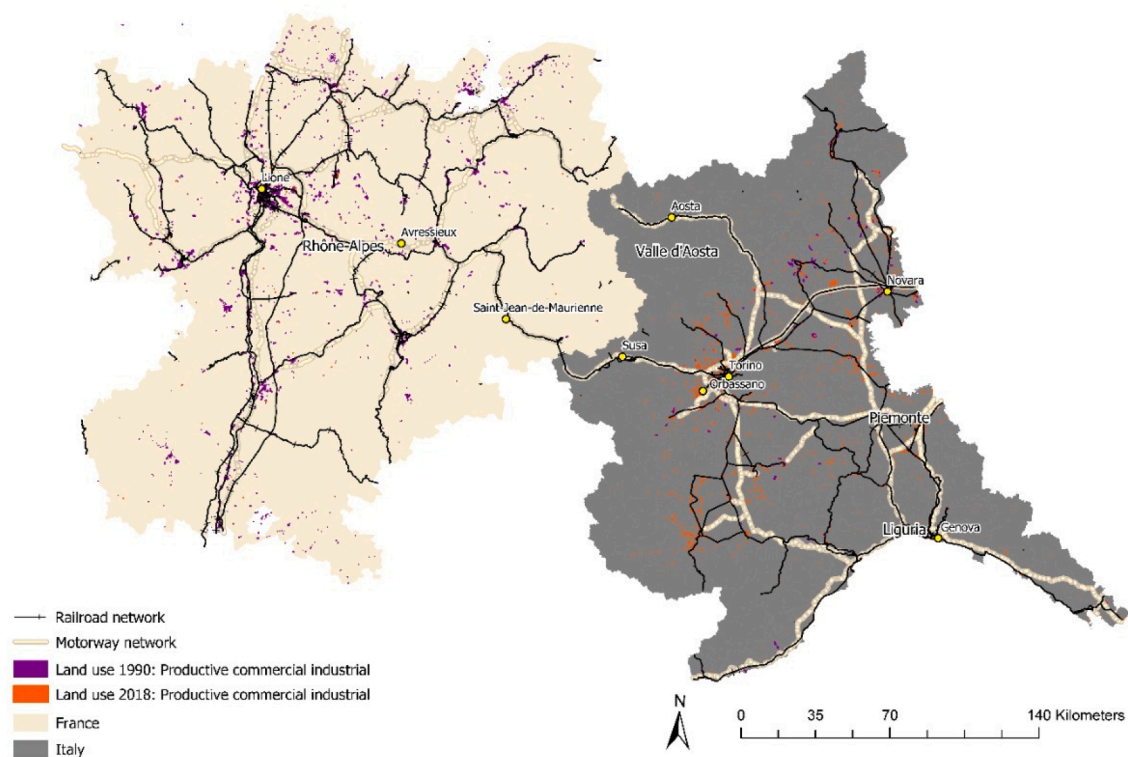


Fig. 6. Difference in the occupation of productive, commercial and industrial land use-PCI. Years 1990 and 2018. Axis 1 Lyon-Turin (Source: Author).

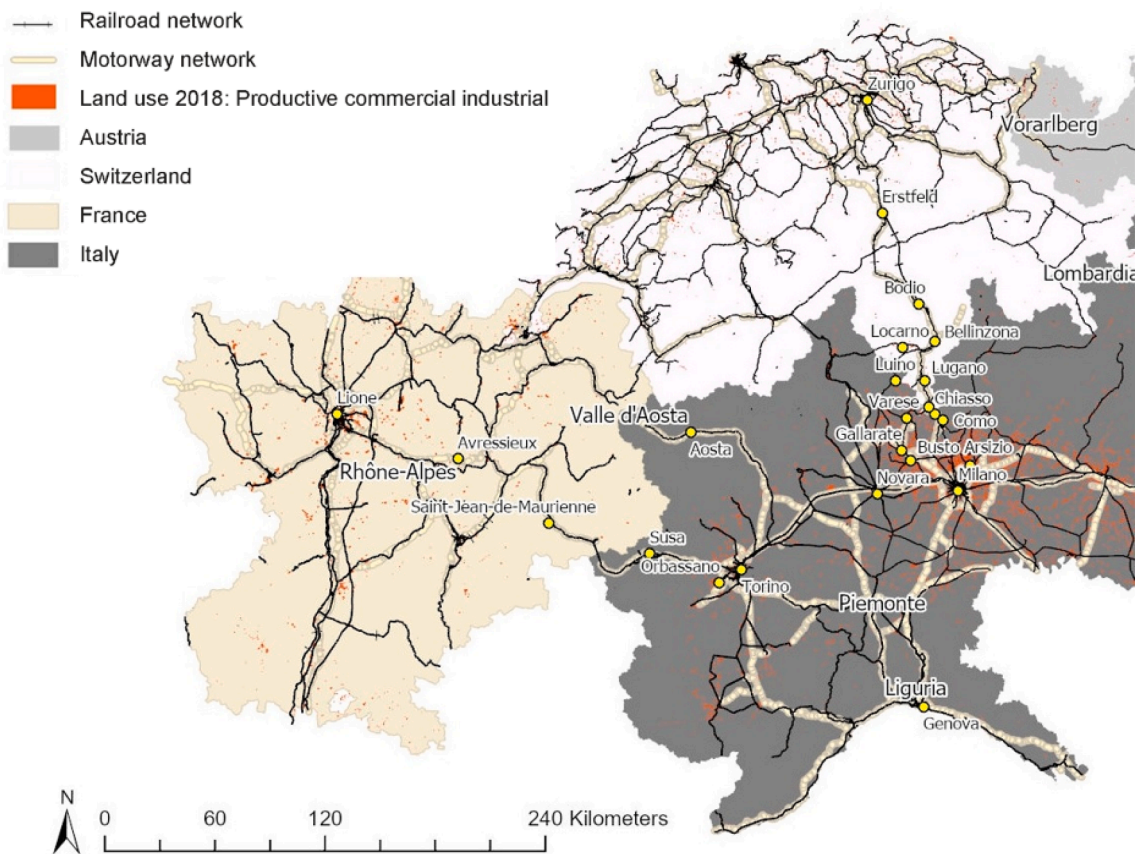


Fig. 7. Occupation of productive, industrial and commercial land use-PIC. Year 2018. Axis 1 Lyon-Turin and axis 2 Milan-Zurich (Source: Author).

analyzed, according to the 7 main impacts detected that they were intended to achieve, the protection of the Alps, the efficiency of AV/AC cargo transport over long distances, the European construction standards of rail infrastructures, integration into the *trans*-European rail corridors and interoperability, the increase in intermodal accompanied rail motorway services, the increase in unaccompanied transalpine intermodal rail traffic TCNA and the empowerment of the Gotthard System. The evaluation scale goes from -3 to 3 (Fig. 4).

The Swiss policies are confirmed to be long-term according to their structure, objectives, approval process, monitoring, execution of strategic projects and relevance, they have a scheduled evaluation and thus be able to make the respective corrections. The objectives with the greatest impact are mainly long and medium term, additionally, intermediate objectives are proposed that help in the monitoring process, a situation that does not happen with the policies for the construction of the TAV Turin-Lyon, which prove to be short-term and with a weak intention of participatory programming. Above all, in Italian territory opposition persists due to poor management of popular consultation, insufficient justification in economic terms for the new Turin-Lyon TAV tunnel and a weak integrated framework of policies in transferring freight traffic from road to rail (Marletto, 2011).

4.2. Land occupation by PIC use according to the three levels of analysis

At the metropolitan level, there is evidence of a significant increase, in relation to the occupation of the land for PIC use of axis 2 Milan-Zurich between the years 1990 (before) and 2018 (after), with respect to axis 1 Lyon-Turin. Graphically this increase is represented in green, it can be seen how the industrial sector has developed more strongly on axis 2 Milan-Zurich (Fig. 5) than axis 1 Lyon-Turin (Fig. 6), it is attributed that the Transalpine goods transport policies, applied by the Swiss government, have had a transversal influence on this result. In the year

2000, no significant differences were detected with respect to the year 1990.

In 2018, it is verified that the Lombardia region (axis 2) has 43,776.6 ha, a larger area compared to the regions of Piemonte, Valle d'Aosta and Liguria (axis 1) with 15,593.6 ha, (Figs. 5, 6 and 7).

At a cross-border level, 33 cities of axis 1 (Turin-French border) located along the railway line that have a railway stop and of axis 2 (Milan-Swiss border) 100 cities of the Lombardy region are analyzed and 18 cities in the Piemonte region that have a greater relationship with axis 2 than with axis 1. They correspond to 2,952.6 ha in PIC use on axis 1, a lower value when compared to the 8,193.2 ha of axis 2 divided into 7,126 0.9 ha in the Lombardy region and 1,066.3 ha in the Piemonte region.

With the comparative results (Figs. 5, 6 and 7) it is confirmed that the Gotthard Base Tunnel (Axis 2), has a significant influence at the trans-boundary level (Fig. 8), if we compare it with axis 1, confirming the hypothesis. Transport infrastructures are essential for the quality and efficiency of commercial logistics corridors, as they are a fundamental tool in the development of manufacturing companies and the economic strengthening of a territory, according to the Quality Logistics Italian Index-QLI proposed by SRM and Contship Italia Group, has interviews conducted with 400 manufacturing companies from three regions of northern Italy, Lombardia (150), Veneto (150) and Emilia Romagna (100), which represent more than half of the Italian Export (SRM & Contship, 2018), among the four main categories of study are infrastructures, costs, services, and sustainability, highlighting the importance of sizing and accessibility to infrastructures and the availability of high-speed rail services (AV) to maintain the quality of logistics systems.

At the local level, the comparative analysis was not possible due to lack of information (see Methodology). If all the information had been available to compare, for example, hectares of PIC uses by axes every 5

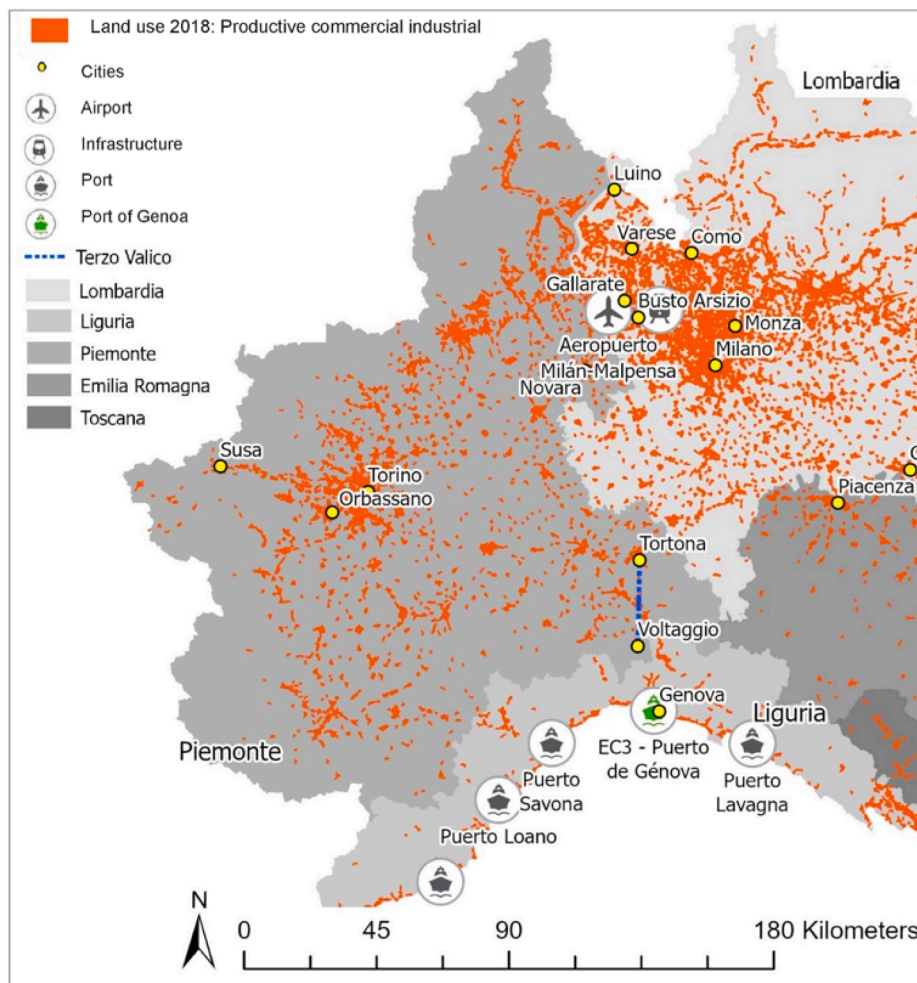


Fig. 8. Occupation of productive, industrial and commercial land use-PIC, year 2018. Axis 1 Lyon-Turin and axis 2 Milan-Zurich in cross-border Italian territory (Source: Author).

years, this would even help to obtain enough points to apply the statistical indices commonly applied for the Mann-Kendall trend analysis, which helps to identify changes in land use more precisely (Militino et al., 2020). In Appendix Table A.2 is attached the table of variations of the years of occupation of the PIC land use that is counted.

4.2.1. Transformation of the land by works that potentiate the Gotthard system according to three levels of analysis

As a result of the Swiss participatory public policies in favor of empowering the Gotthard System, at the metropolitan level on axis 2 Milan-Zurich represented in red (Fig. 9), 14 tunnels were built as part of the four-meter corridor (C4m), including: the expansion of 11 tunnels with the possibility of loading semi-trailers 4 m high, the construction of 3 tunnels and the expansion of train parking in different stations with 740-meter-long platforms, new systems of signaling and several sections with electric railway traction. Works carried out in Swiss and Italian territory, with Swiss financing, as well as the positioning of the Swiss intermodal company HUPAC SpA in Italian territory in the cities of Busto Arsizio and Gallarate (245,000 m2) and its various shareholdings in the CIM Novara Interport, these two Terminals are strategic for transalpine transport, forming a cluster of intermodal transport and logistics companies in their surroundings. On the other hand, in axis 1, the execution of complementary works and of enhancing it is limited.

At the cross-border regional level (T) represented in purple (Fig. 9) of axis 2, there are mainly 8 infrastructure projects and only 1 in axis 1, new infrastructures, expansion and modernization works are identified; On the other hand, in Axis 1 this type of project is a minority (Appendix

Table A.3). For example, the connecting railway line between Seregno and Bergamo T1, the Milano Smistamento T2 intermodal center and the new Como-Varese-Milan Malpensa Airport cross-border railway lines represented by the T8. On the other hand, in axis 1 only the strengthening of the Turin interport was identified.

At the local level (L) represented in blue (Fig. 9), axis 2 especially has 8 ecological and hydraulic compensation works, for example we can name the ones found in the photos (Fig. 10): the lakes of cooling in Poggio L1, the artificial green hill in Biasca L2 that works as a deposit for excavation material, of approximately 7 million tons, the artificial Lake Lac de Claus L4, which used 2.9 million tons and the Six Artificial Islands Lorelei L5, made up of 2.6 million tons of excavation material. In axis 1, the works are limited compared to axis 2 (Appendix Table A.3 and Fig. 9), but as in the Gotthard there is a reuse of the excavated material, of the 28 million tons extracted, 66.3 % was used for the filling of railway tracks, compensation projects detailed below, 33 % of this material was destined for the production of concrete, which was used inside the tunnel and only 0.7 % was destined for urban dumps.

Behind the construction of a base tunnel, as this research demonstrates, a number of works emerge as a direct impact by potentiating the Gotthard system, thanks to Swiss vision, planning and coordination. But what about the issue of resilience, this leads to the following questions: Can the construction of new infrastructure such as the Gotthard Base Tunnel make the transport system more resilient? And what can this infrastructure contribute?

With the effects caused by the war in Ukraine and the Covid-19 pandemic, the Gotthard system together with the competent

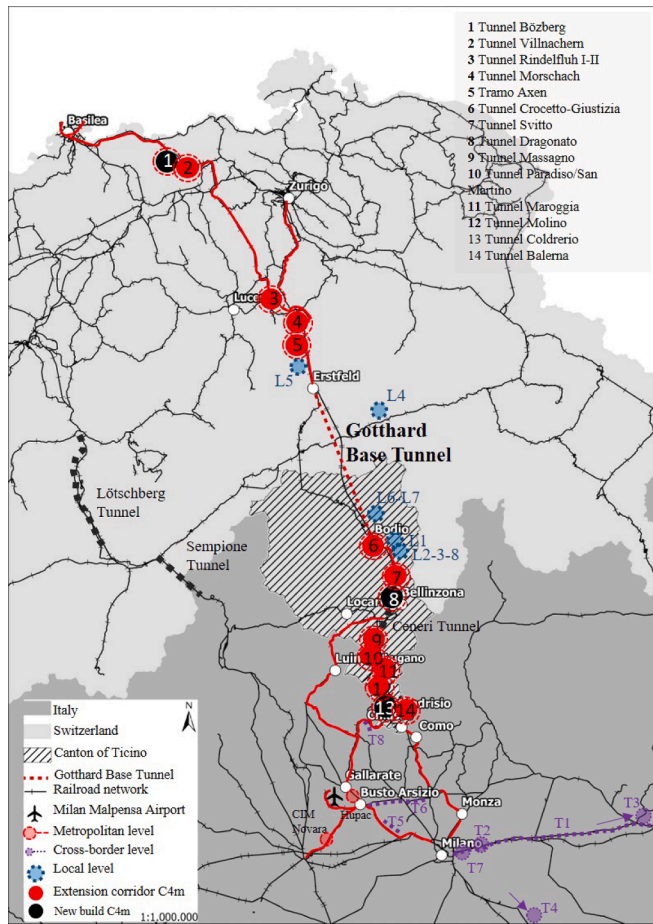


Fig. 9. Main complementary works, of compensation and that potentiates the Gotthard System, according to the three levels of analysis (Source: Author).

authorities have to consider resilience as a strategic priority. Some instruments that address this situation were identified, such as the Next Generation EU fund and jointly with the National Recovery and Resilience Plan (PNRR acronym in original language), which aims to counteract the economic and social damage caused by the Covid-19 pandemic in a sustainable, inclusive and resilient mode (priority measures in investments in the railway network, intermodality and integrated logistics M3C1-2), during the period 2021–2027 (Consejo Europeo, 2020), can guarantee certain levels of safety standards in railway infrastructures and the optimization of resources.

The SICt-Cross-border Critical Infrastructure Security project,

between the Italian provinces of Varese, Como, Lecco and the southern area of the Ticino canton in Switzerland, is financed by the Interreg Cooperation Program with EU, Italian, Swiss and private funds (Interreg, 2021). By having cross-border cooperation, the project helps to monitor, to have adequate information flows and to strengthen joint management due to the partial or total interruption of critical road and rail transport infrastructures (Regione Lombardia, 2020). This instrument “can be considered a Decision Support System (DSS) for the management of relevant events that may have impacts on the two countries” (Borhetti et al., 2020, p. 7).

According to the Strategic Document for rail mobility of passengers and goods, it is considered a strategic rail axis within the scope of the TEN-T network, it has a Climate Change resilience program, based on three guidelines: (i) Data, research and simulation of future climate hazards in infrastructure, (ii) Technology, digital innovation, resilient infrastructure and (iii) Adaptation Action Plan. It is intended to make the railway network more resilient also through network maintenance activities “according to criteria, methodology and processes based on environmental, social sustainability and circularity” (Mims, 2021, p. 74).

The answer to our question is whether the Gotthard Base Tunnel has favored the entire transport system, both cross-border and part of the TEN-T Rhine-Alps corridor, with the modernization of railway infrastructures to European standards along the corridor of 4 m, with digital infrastructure at the forefront and that is considered a priority not only as a tunnel but also as a logistics system, this facilitates investment processes and international agreements to strengthen the resilience of the infrastructure and this in turn to increase the resilience of the cities involved.

4.3. Conclusions of the interviews by class groups and information triangulation

In the triangulation by classes, the hypothesis was confirmed by the interviewed experts, who validated the results. The interviewees were asked to describe the Gotthard Base Tunnel in five words, this was a way for negative aspects of the tunnel to surface, the answers were various and surprisingly positive. In summary, the class group A, described it as a European model, sustainable, interoperability and systemic vision. Group B as ambitious, felt like their home, opportunity and imposing; group C as an added value to the railway system, challenge overcome, intermodality, surgical precision in time and costs and which unites. Each group made the description according to their experience and vision. Confirmed that this megaproject of transport and logistics infrastructure, although it does have an impact on the occupation and transformation of the land, can be considered a model of railway policies, infrastructure financing mechanisms and participatory processes.

The interviews were developed with semi-structured questions in



Fig. 10. Some ecological and hydraulic compensation works at the local level of the Gotthard System (Source: Authors).

relation to objectives, a priori categories, subcategories (Table 1) and identifying critical-relevant questions (CRP) and contrast questions related to axis 1 (PPC). The time scheduled for each interview was 1 h, however, it was extended in many cases up to 1 h and 48 min, everything depended on the availability of the interviewee and knowledge of the subject to be discussed. In order to help determine future policies, a SWOT analysis of the interviews is carried out, which is detailed in Appendix Table A.4.

It is concluded in the triangulation, that thanks to the instruments and policies implemented in: 1991, with a popular vote the realization of the New Transalpine Railway-NFTA was approved, in 1999, the amendment of the constitution for the protection of the Alps was approved art. 84 (freight traffic from border to border must be by rail), in 2000 the Heavy Traffic Tax Commensurate to Benefits-TTPCP was introduced, in 2013 the FIF fund to finance large railway projects, fueled by the tax to heavy traffic-TTPCP, the personal income tax, annual fixed contribution of the cantons, the annual general fund of the Confederation and the fuel tax, in 2014 the 4-meter corridor and the expansion of terminals, in 2017 The *Ferrobonus* is approved in Italy and in 2019 the compensation for unaccompanied combined transport-TCNA in Switzerland is increased, mainly these policies have had a significant impact on the transformation and occupation of cross-border land in northern Italy.

For future research, the multimodal rings generated by the Gotthard system and their effects on the territory where they are implanted could be investigated, for example, the synergy that is created between the Malpensa Airport in Milan, the railway connections of the Saint Gotthard corridor and the project NFTA, as well as the intermodal transport cluster that have been generated around HUPAC in the cities of Busto Arsizio and Gallarate in northern Italy.

5. Conclusions

There are seven policies that favored to potentiate the Gotthard System to bring it up to European standards, but as the research shows, they have had an impact on the occupation and transformation of the land at the three levels of analysis, due to the construction of complementary works and ecological compensation, agricultural and hydraulic, the physical and biological cover have been altered. Undoubtedly, these measures have contributed to the protection of the Alpine environment, but the problem of the occupation and transformation of the land has been displaced to Italian cross-border regional levels. Due to its proximity to the SG base tunnel, the local level was the one with the greatest contribution to the circular economy compared to the other two levels, the specific contribution in the reuse of excavation material was 27.8 million tons.

The Swiss Fund for Financing Railway Infrastructure has proven to be a highly effective system, an innovative instrument (Bacelli & Barontini, 2014), forward-looking (*lungimirante*), provides stability and guarantees long-term financing, offers the New Transalpine Railway (NFTA) and other large projects such as the Saint Gotthard base tunnel, two important advantages: it guarantees the financing of the entire work even before starting work and avoids insecurities due to suspensions in construction or difficulties in obtaining financing in the execution process of the work.

The participatory policies (referendum) applied for the construction of the Gotthard axis could not work without accompanying measures and complementary policies that allow the objectives set for this type of transport and logistics megaproject to be achieved. The Tax on Heavy Vehicles According to Performance (TTPCP in original language), was not only the main source of financing for the NFTA, thanks to it, more equitable conditions were also generated between road and rail transport, since it revealed the costs that were not covered by the traffic of merchandise by road and this guaranteed the veracity of the costs.

When defining the need to build a large infrastructure such as the Gotthard Base Tunnel, it is essential for it to be efficient and sustainable, that from decision-making it must be participatory, that the sources of

financing be well structured, publicly defining the percentages of the source, approved collectively, delimited in time to be able to update and adjust them if necessary. Additionally, there must be articulated accompanying policies that potentiate the entire system in the medium and short term, not considered as a one-off project but as part of an interregional and international transport logistics corridor. The impacts of building an infrastructure of this type should be evaluated, not only at the national level but also across borders, since the impacts on the transformation of the land are displaced and articulated according to the corridor to which the project belongs.

It is essential that policies are articulated in the long term and that they are born with the priority of protecting the natural environment and transferring cargo transport from road to rail, as was the case in Switzerland, setting clear goals for cargo transfer in established times, this helps to monitor the situation after the construction of the infrastructure. The research identifies the need to articulate different policies such as intermodal freight transport, freight and passenger transport, modernization of existing infrastructures before building new ones, rationalization of railway lines and rolling interoperability, circular economy (for the prevention and elimination of waste for the construction of large infrastructure projects), financing for large infrastructures and economic incentives for companies that offer to increase the transport of their merchandise by intermodal transport. It would be interesting in future research to verify in successful cases if these aforementioned characteristics are common factors.

Two typologies are detected between the compensation works and complementary projects analysed, the first corresponds to the cross-border metropolitan and regional level (M–RT), they present formally linear characteristics of railway connection and intermodal logistics infrastructure, while the second type, formally, are punctual projects, located in areas adjoining the two tunnels and a few kilometers away (L), which function as support and compensation buildings.

The research hypothesis is confirmed, the impact of land occupation by the PIC use of axis 2 of the Saint Gotthard base tunnel is significantly higher than axis 1 of the Lyon-Turin base tunnel. The comparative mixed method used proves to be useful for measuring the impacts caused by long-term policies on the occupation and transformation of land by this type of infrastructure.

6. Glossary

Rolling highway: It is a combined transport system, which consists of a railway shuttle line, intended for the transport of trucks. The trucks travel by road to the beginning of the railway line, are mounted in special wagons and are unloaded at the final station to continue by road to their destination.

Agreement: It is a written document between States with a degree of formality, less than a treaty.

Railway gauge: specifies the maximum dimensions of the rolling stock in relation to the cross section with respect to the track, so that in this way trains can pass through the tunnels safely, by maintaining a necessary space for other trains to pass or minimum distances free of obstacles.

Trans-European rail systems: The *trans*-European rail system encompasses all vehicles capable of traveling on all or part of the *trans*-European conventional or high-speed rail network.

Intermodal transport: Intermodality, defined as a characteristic of a transport system by virtue of which at least two different modes of transport are used in an integrated manner to complete a door-to-door transport chain, allows, through a global approach, a more rational use of the available transport capacity.

International treaty: It is an international agreement concluded in writing between States and governed by international law.

CRedit authorship contribution statement

Zaira Tello-Toapanta: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A1
Georeferenced data table example.

FID_Cd	COD_R	COD_F	COD_P	COD_C	COD_U	PRO_C	PRO_C	Cities	COMU	CC_UT	SHAPE_LEI	Regior	Shape	Shape_Area	
1845	1	3	18	0	18	18122	018122	Rivanazzano Terme			0	32295,73897	Lombardia	3937,7466	402403,6863
1198	1	3	18	0	18	18051	018051	Codevilla			0	21751,32472	Lombardia	1118,4664	66835,34185
3563	1	3	18	0	18	18095	018095	Montebello della Bat			0	25215,13172	Lombardia	1901,6679	210359,9498
4837	1	3	18	0	18	18182	018182	Voghera			0	47565,86762	Lombardia	1414,5285	44597,0953
4970	1	3	18	0	18	18155	018155	Torrazza Coste			0	22127,12893	Lombardia	1677,4635	63887,0445
4837	1	3	18	0	18	18182	018182	Voghera			0	47565,86762	Lombardia	5887,867	616038,9306
1196	1	3	18	0	18	18033	018033	Casei Gerola			0	36947,7049	Lombardia	3089,8607	405241,726
1196	1	3	18	0	18	18033	018033	Casei Gerola			0	36947,7049	Lombardia	2320,1438	276421,3434
1734	1	3	18	0	18	18149	018149	Silvano Pietra			0	23468,93066	Lombardia	332,66227	5274,8898
1555	1	3	18	0	18	18116	018116	Pizzale			0	15898,49304	Lombardia	2241,6403	60930,43945
2688	1	3	18	0	18	18038	018038	Castelletto di Brandu			0	24352,89822	Lombardia	477,40447	1119,17395
4999	1	3	18	0	18	18084	018084	Lungavilla			0	12592,53778	Lombardia	3233,7994	196301,8914
4915	1	3	18	0	18	18032	018032	Casatisma			0	13064,67949	Lombardia	4953,4374	437008,8526
4852	1	3	18	0	18	18024	018024	Broni			0	38715,33431	Lombardia	2752,3158	260229,943
2822	1	3	18	0	18	18090	018090	Mezzana Bigli			0	31818,36653	Lombardia	3048,5953	253967,5029
3870	1	3	18	0	18	18005	018005	Arena Po			0	25864,13978	Lombardia	3229,6789	386268,0609
1570	1	3	18	0	18	18153	018153	Stradella			0	27204,41386	Lombardia	903,49754	20306,7554
4976	1	3	18	0	18	18133	018133	San Cipriano Po			0	13683,49846	Lombardia	2934,6791	240069,3001
1018	1	3	18	0	18	18138	018138	Sannazzaro de' Burgo			0	37064,96992	Lombardia	7318,2584	1708241,382
4901	1	3	18	0	18	18062	018062	Ferrera Erbognone			0	29611,76985	Lombardia	6526,2573	1586820,012
1729	1	3	19	0	19	19036	019036	Cremona		1	51445,16153	Lombardia	3218,1185	416954,4525	
1729	1	3	19	0	19	19036	019036	Cremona		1	51445,16153	Lombardia	5089,7604	447980,6329	
1729	1	3	19	0	19	19036	019036	Cremona		1	51445,16153	Lombardia	4040,8373	570871,154	
786	1	3	18	0	18	18061	018061	Dorno		0	38331,76821	Lombardia	2842,0444	288529,9702	
1729	1	3	19	0	19	19036	019036	Cremona		1	51445,16153	Lombardia	3305,2929	490496,4362	
1729	1	3	19	0	19	19036	019036	Cremona		1	51445,16153	Lombardia	5499,6988	1215198,138	
1729	1	3	19	0	19	19036	019036	Cremona		1	51445,16153	Lombardia	7812,7321	1464099,255	
1843	1	3	19	0	19	19095	019095	Sesto ed Uniti		0	38639,46551	Lombardia	1346,096	42285,09145	
4442	1	3	19	0	19	19100	019100	Spinadesco		0	23338,83368	Lombardia	4381,165	276904,9456	
6983	1	3	98	0	98	98019	098019	Codogno		0	24358,35554	Lombardia	5172,2519	690346,8538	
6997	1	3	98	0	98	98026	098026	Fombio		0	17771,59343	Lombardia	3784,7497	419178,2717	
1843	1	3	19	0	19	19095	019095	Sesto ed Uniti		0	38639,46551	Lombardia	2709,7149	154837,9144	
3642	1	3	19	0	19	19001	019001	Acquanegra Cremonese		0	19541,57641	Lombardia	979,0395	52194,50345	
4442	1	3	19	0	19	19100	019100	Spinadesco		0	23338,83368	Lombardia	1622,4735	131397,0316	
1017	1	3	18	0	18	18137	018137	San Martino Siccomario		0	21521,55349	Lombardia	3704,8556	308273,9638	
6723	1	3	98	0	98	98010	098010	Casalpusterlengo		0	31002,65696	Lombardia	2568,6373	260286,5297	
6762	1	3	98	0	98	98054	098054	Somaglia		0	34236,30254	Lombardia	1625,6897	76499,07785	
1467	1	3	18	0	18	18076	018076	Gropello Cairoli		0	32725,54508	Lombardia	3570,1873	443045,7211	
6723	1	3	98	0	98	98010	098010	Casalpusterlengo		0	31002,65696	Lombardia	504,66809	5715,6784	
6762	1	3	98	0	98	98054	098054	Somaglia		0	34236,30254	Lombardia	3307,556	292296,3615	
1728	1	3	19	0	19	19076	019076	Pizzighettone		0	31528,038	Lombardia	3364,3775	399821,7177	
1748	1	3	19	0	19	19026	019026	Castelverde		0	36608,73514	Lombardia	3404,5014	275020,8853	
1467	1	3	18	0	18	18076	018076	Gropello Cairoli		0	32725,54508	Lombardia	4014,5246	273907,1077	
1560	1	3	18	0	18	18110	018110	Pavia		1	47929,20357	Lombardia	5072,4595	697863,3353	
1560	1	3	18	0	18	18110	018110	Pavia		1	47929,20357	Lombardia	2941,838	394911,656	
6723	1	3	98	0	98	98010	098010	Casalpusterlengo		0	31002,65696	Lombardia	4848,0961	463155,2649	
1560	1	3	18	0	18	18110	018110	Pavia		1	47929,20357	Lombardia	2953,3063	475777,0834	
1560	1	3	18	0	18	18110	018110	Pavia		1	47929,20357	Lombardia	3050,0771	437161,2411	
1560	1	3	18	0	18	18110	018110	Pavia		1	47929,20357	Lombardia	2890,3151	365872,6621	
6723	1	3	98	0	98	98010	098010	Casalpusterlengo		0	31002,65696	Lombardia	2897,1698	252538,9923	
1560	1	3	18	0	18	18110	018110	Pavia		1	47929,20357	Lombardia	6481,9753	566080,1118	
6872	1	3	98	0	98	98057	098057	Terranova dei Passerotti		0	23296,91942	Lombardia	2576,3731	256883,6647	
6760	1	3	98	0	98	98052	098052	Secugnago		0	15151,90611	Lombardia	3856,5874	208682,5886	
6982	1	3	98	0	98	98006	098006	Brembio		0	27496,43018	Lombardia	1461,0506	42724,9693	
764	1	3	98	0	98	98058	098058	Turano Lodigiano		0	29214,10974	Lombardia	3374,517	333051,0286	
6867	1	3	98	0	98	98002	098002	Bertonico		0	27148,97651	Lombardia	4473,608	822619,3402	
6872	1	3	98	0	98	98057	098057	Terranova dei Passerotti		0	23296,91942	Lombardia	202,06967	773,7195	

Table A2 Land occupation of Productive, Industrial, Commercial (PIC) use by years, axes and levels according to data obtained (Source: Author).

	Axis 1			Axis 2			Axis 1			Axis 2		
	Piemonte, Valle d'Aosta and Liguria (Italy)	Rhone-Alpes Region (France)	Lombardia (Italy)	Switzerland	Piemonte, Valle d'Aosta and Liguria (Italy)	Rhone-Alpes Region (France)	Lombardia (Italy)	Switzerland	Piemonte, Valle d'Aosta and Liguria (Italy)	Rhone-Alpes Region (France)	Lombardia (Italy)	Switzerland
km ² a ha=	34,06,400	38,883.2	23,84,400	0	18,087.2	38,883.2	18,087.2	0	18,087.2	38,883.2	18,087.2	0
Year	1990	1990	1990	2018	1990	1990	1990	2018	1990	1990	1990	2018
Productive Commercial Industrial	18,087.2	38,883.2	40,977.0	0	18,087.2	38,883.2	18,087.2	0	18,087.2	38,883.2	18,087.2	0
Productive Commercial Industrial	15,593.6	32,567.7	43,776.6	23,109.8	15,593.6	32,567.7	15,593.6	43,776.6	15,593.6	32,567.7	15,593.6	43,776.6
					Metropolitan level	Metropolitan level	Metropolitan level		Metropolitan level	Metropolitan level	Metropolitan level	
					33 cities (Turin-French border) that have a railway stop	33 cities (Turin-French border) that have a railway stop	33 cities (Turin-French border) that have a railway stop		100 cities in the Lombardy region and 18 cities in the Piemonte region (Milan-Swiss border) have a railway stop	100 cities in the Lombardy region and 18 cities in the Piemonte region (Milan-Swiss border) have a railway stop	100 cities in the Lombardy region and 18 cities in the Piemonte region (Milan-Swiss border) have a railway stop	

Table A3

List of works that enhance the base tunnels of axis 1 and axis 2. Cross-border regional level and Local level (Source: Author).

Cross-border regional level.	
Axis 1 Lyon – Turin	Axis 2 Milan – Zurich (Gothard Base Tunnel)
Strengthening of the Turin interport S.I. T.O. Spa in rail, logistics and intermodality services. Cost 500 million euros.	T1. Railway connection Seregno-Bergamo 32 km, cost 1,000 million euros. T2. Terminal intermodal center “Milano Smistamento”. 400,000 m ² . Cost 80 million euros. T3. Brescia Terminal “La Piccola Velocita”. Cost 60 million euros. T4. Piacenza Terminal “Le Mose”. Cost 60 million euros. T5. Strengthening of the Rho-Gallarate railway line, 25 km and a fourth platform between the stations of the cities of Rho and Parabiago. Cost 723 million euros. T6. Strengthening of the Novara-Malpensa-Seregno 14 km railway line. Cost 393 million euros. T7. Public park and the biotope-phytopurification project. Tregarezzo, 8,264 m ² . T8. New Arcisate-Stabio railway line and the Como-Mendrisio-Varese-Malpensa Airport connection. Cost 261 million euros
Local level	Axis 2 Milan – Zurich (Gothard Base Tunnel)
Axis 1 Lyon – Turin	Axis 2 Milan – Zurich (Gothard Base Tunnel)
Urban regeneration in the Maurienne Valley area (France)	L1. Cooling ponds of drainage water from the mountain where the tunnel passes before directing it to the Ticino River. 7,100 m ² , construction period 2014–2015, located in Pollegio, Ticino canton. L2. The artificial green hill in Biasca, as a deposit for excavation material, was approximately 7 million tons, it was built from 1999 to 2019. L3. Afforestation of the abandoned areas of Santa Petronilla in Biasca, Ticino canton. Year 2005. L4. Lac de Claus artificial lake in Sedrun, 2.9 million tons of excavation material was used, located in Tujetsch, canton Grigioni. L5. Six artificial Lorelei Islands, made up of 2.6 million tons of excavated material, were built in the period 2000–2005, the cost was 23 million euros, located in Seedorf, canton Uri. L6. El Portal Building, made up of the central ventilation and railway technical area, was built in the period 2012–2014, located in Faido, Grigioni canton. L7. Faido portal square, made with crushed material from the excavation of the tunnel located in Faido, Grigioni canton L8. Justice Node, made up of the 7 km tunnel on the south side of the SG base tunnel, the bridge with two High Speed railway binaries over the Froda River, a retention chamber (5,500 m ³), the embankment of the modified cantonal highway and the new emergency access to the Justicia highway. Built in the periods 2000–2002 and 2011–2015, the approximate cost was 30.8 million euros.
14-hectare tunnel excavation material deposit	
Concrete ring factory (<i>concio</i>) in the Saint-Martin-La-Porte area, Salbertrand, Turin, the estimated construction period is 2019–2028	
Storage tanks for the waste material from the tunnel excavation located in Caprie and Torrazza Piemonte, (Italy).	
External groundwater cooling tanks for the excavation of the tunnel, in Chiomonte (Italy).	

Table A4
SWOT of 14 interviews (Source: Author).

Objectives of semi-structured interviews:
 * Recognize if there are convergent points that reinforce the validity of the detected impacts.
 * Deepen the relevance of long-term policies with respect to short-term ones.
 * Know the influence of Swiss transport and logistics policies on Italian policies.

A priori categories	Subcategories	Questions sample	Strengths	Weaknesses	Opportunities	Threats
Alpine policy	* Construction of the San Gottardo Base Tunnel (SG)	In the scenario of the construction of a large infrastructure such as the Gotthard Base Tunnel, do you consider that long-term public policies can have a significant impact on the development of a territory, unlike short-term policies, and if so, what way?	<p>*Long-term policies have a significantly greater influence than short-term policies over the 30-year time frame.</p> <p>*The long-term policies implemented have strengthened the entire Gotthard system, generating new activities related to intermodal transport and logistics, generating new jobs.</p> <p>*The long-term policies implemented seek to efficiently favor rail interconnection and the distribution of merchandise from the north to the south to the Mediterranean, not only at the local level.</p> <p>*The Swiss Confederation understands that the railway is a fundamental axis for economic development, for this reason it rescues and buys the railway that in the past was totally private, history tells that Switzerland was born thanks to the railway.</p> <p>*International conventions since 1869 for the construction and operation of the railway across the Gotthard.</p> <p>*Swiss federal railway law explains the right reducing normal vehicle traffic, are at risk to stay isolated.</p> <p>*The realization of the SG base tunnel envisaged several hectares of Surfaces for crop rotation - SAC, these surfaces are compensated with surfaces of the same size and quality, the responsibility was AlpTransit.</p>	<p>*So many European countries do not give priority to generating long-term policies on intermodal freight transport issues.</p> <p>*Generate complementary policies and measures to resolve the increase in the flow of merchandise and high-speed trains in small towns that negatively impact urban life after the opening of the San Gotardo tunnel, since the new trains are longer than 740 m and they are much higher than 4m, the waiting times of the cars is greater for the passage of these trains.</p> <p>*Not all the territories involved have an Action Plan against Noise, an Urban Mobility Plan or a Railway Contingency Plan that are necessary due to the increase in rail freight transport.</p> <p>*Impact detected is the low prices of apartments in the central area of Luino (Italy), after the inauguration of the SG base tunnel due to the passage of trains, as well as commercial activities that, by reducing normal vehicle traffic, are at risk to stay isolated.</p>	<p>*Long-term policies define the structured vision to organize projects at different levels, while short-term policies solve problems immediately, in a timely manner and in a short time according to territorial requirements, there must be a strategy of balanced use of political instruments and mechanisms, since long-term policies have a greater territorial impact.</p> <p>*The cities integrated to the AV railway line have great benefits, such as improving the situation of the high vacancy rate of rental real estate or improving tourism.</p> <p>*AlpTransit left a pipe in the Swiss city of Bodio that carries piped water drained from the mountain at a temperature of 28° that could serve as a heating system for houses, which is currently closed due to lack of budget.</p> <p>*Reduction of the distance time between Milan and Zurich (around 30-40 minutes) competing with air transport in this section.</p>	<p>*There should be regulations in force throughout Europe but this is not the case, each country has its regulations, for example: in Italy it is the only country that 2 people must be in the locomotive at the level of drivers, while in other countries it is seen the need even for locomotives to travel without a driver in autonomous mode or also known as driverless. In a European country the color of the safety vest is different, it must be yellow and not orange as we are used to in Italy, that is, the rules are different and it does not reflect the interest of the European Union as it should be in all aspects included long-term rail transport policies.</p> <p>*Lack of coordinating actions with authorities at different levels.</p> <p>*There is a risk that small Swiss towns like Bodio, which used to be touristic, end up isolated because the trains are AV and go directly to the big cities like Lugano, Bellinzona and Lucerne.</p>
Critical or relevant question						
A priori categories	Subcategories	Sample questions	Strengths	Weaknesses	Opportunities	Threats
Alpine policy	* Railway infrastructure financing instrument	Do you consider that the Swiss FIF financing mechanism for large railway infrastructure is effective compared to the Italian one? and because?	<p>*The Swiss financing mechanism is clear and transparent, it corresponds to the confederation's own characteristics, it is largely cultural. In Switzerland everything is codified and is part of the Federal System.</p> <p>*The FIF and the strategic development program of railway infrastructures (PROSIF) are long-term policies.</p>	<p>*In Italy the sources of financing are not clear, there is no predefined budget such as the Helvetic FIF mechanisms. In general, it is the Italian Central Government together with the Ministry of Transport that decides the financing mechanisms for railway infrastructures, to later allocate the financing to the regions according to the project.</p>	<p>*Italy and other countries could use the Swiss financing mechanisms as a reference.</p>	<p>*By not having a financing mechanism for large infrastructures, these could take longer than expected in the construction or simply paralyze the works.</p>
	* Instruments of public debate for the construction of large infrastructures	For the construction of railway infrastructure megaprojects, are the mechanisms of public debate and referendums essential for their correct viability, as in the Swiss case?	<p>*The peculiarity of their own territory, in Switzerland there are few inhabitants, they live in a homogeneous territory, everyone understands the consequences of an alternative that affects the territory.</p> <p>*In Switzerland there is a great ecological sensibility, the railway is part of the Swiss DNA, aware of the fragility of the Alps, this undoubtedly helps in supporting sustainable initiatives.</p> <p>*Since 1848 there is a referendum law applied in Switzerland, unlike Italian or French, it is semi-direct democracy, that is, the Federal Parliament makes decisions, but the people can always express themselves with referendums and make their proposals with a minimum of 100,000 signatures backup.</p>	<p>*Italy has a wide and diversified territory with specific interests (North vs. South), it is not feasible to carry out a referendum system for the construction of large infrastructures.</p> <p>*It is a cultural aspect to support or not sustainable initiatives.</p> <p>*The Turin-Lyon TAV has been under discussion for 20 years, the government changes and it is again under discussion, this would never happen in Switzerland after a referendum is not discussed anymore, the result is respected.</p>	<p>*In Italy by law there must be a space for public debate for the construction of large infrastructures.</p>	<p>*If there is no referendum culture, it may be just an opportunity to spend time and money.</p> <p>*In a vast territory it is difficult to define the population that should vote.</p> <p>*In Italy the referendum is feared to be invalidated by preconceived positions.</p>
Contrast question						

(continued on next page)

Table A4 (continued)

A priori categories	Subcategories	Sample questions	Strengths	Weaknesses	Opportunities	Threats
Long-term and short-term policy efficiency	* Cross-border rail policies	How have Swiss rail policies influenced rail transport and intermodal development policies in Italy?	<p>*Stimulates freight transport companies to be intermodal, example: HUPAC-Italy produces savings of 89% in CO2 emissions due to the use of combined transport and 74% in energy consumption.</p> <p>*Generates a chain of efficient processes within transport companies, for example: Bonus / Malus fees if the client manages to withdraw the merchandise within the first 24 hours, he receives a bonus and if he does not, the opposite happens.</p> <p>*The conditions are created for a more sustainable cross-border mobility between Ticinese and Insubric agglomerations (Como, Varese, Gallarate, Malpensa), considering that daily there are more than 60,000 cross-border workers who move from the Italian provinces of Varese and Como to the canton Swiss Ticino.</p>	<p>*In Italy there is a lack of work on the development of intermodal infrastructure with the possibility of communicating ports, land terminals, airports, a correct communication must be created not only physical but also technological and computer so that there is a true flow of communications as part of a Harmonized System.</p> <p>*The expected speed expectation, the long-distance line (Trenitalia-SBB) Milan – Zurich, conflicts with the cross-border rail service (TILO), it is not easily harmonized between Milan-Como-Chiasso-Lugano-Varese, it is not a direct consequence of the SG base tunnel, but this difficulty has been verified when the base tunnel has created the expectation of going as fast as possible between Milan-Zurich but the railway capacity is limited according to the number of trains that must travel .</p>	<p>*Swiss policies are geared towards the EU White Paper, 2030 and 2050 objectives for rail freight transport policies.</p> <p>*Transport companies can work efficiently and sustainably.</p> <p>*Creation of new clusters of transport and logistics companies.</p> <p>*Generate railway development plans to transform the main sections to high speed (from 120 to 300 km/h).</p> <p>*Creation of the TILO cross-border railway service (between the canton of Ticino and the Lombardy region) between Italy and Switzerland in 2010 in anticipation of the opening of the Gotthard (in 2016), the Mendrisio – Varese railway line is also opened in the year 2018, in April 2021 the new Tilo RE80 line Central Milan-Chiasso-Locarno.</p>	*The other countries of the Rotterdam/Genoa corridor are not in line with intermodal transport policies.
Contrast question						
A priori categories	Subcategories	Sample questions	Strengths	Weaknesses	Opportunities	Threats
Potentialization of the "Gotthard System"	* Complementary work * Compensation work * Works that enhance the tunnel	Do you consider that the compensation, complementary and strengthening works for the tunnel are adequate? What would change?	<p>*Reuse the tunnel excavation material in compensation and complementary works due to its proximity.</p> <p>*They were carried out according to feasibility studies</p>	<p>*Monitoring instruments to control the effective sizing of ecological, hydraulic and agricultural compensation works.</p> <p>*Investment process in Italy has longer times, Switzerland pressures to invest economically in Italian territory to improve the railway network, aware that the market of interest is Italian.</p>	*The works that enhance the Gotthard system are a fundamental part of the European transport corridor Rotterdam-Genoa.	*Correct maintenance of the compensation and complementary works that enhance the SG tunnel
Land occupation for PIC use	* Difference in hectares of PIC use between axes 1 and 2.	How can the Gotthard Base Tunnel affect the occupation of land for productive, industrial and commercial use on the Milan-Zurich and Turin-Lyon north-south axes?	<p>*The location in Italian cross-border territory of large intermodal traffic network managers at European level that are part of the two axes.</p> <p>*For productive, industrial and commercial activities it is strategic to locate near the Gotthard axis as it is a competitive advantage.</p>	*According to the Lombardy Region, it is thought that the appropriate period to analyze the impacts produced by a railway infrastructure of this magnitude is 10 years, before which it is possible to make forecasts of the possible impacts, but without certainty. For example, only after 10 years do the Milan-Turin or Milan-Rome lines reach a level of reasonable use and are integrated into the daily life of the population. Currently, the railway scenario has changed drastically due to COVID-19 and it will take even longer to measure the impacts.	<p>*In Italy, the development of commercial activities related to intermodal transport and logistics according to terms of respect for the environment, considering municipal regulations and compatibility studies (areas close to HUPAC).</p> <p>* In the upper Ticino area in Switzerland, the old metallurgical industries that went bankrupt in the 90s, now have the possibility of developing activities related to logistics in these large warehouses, thanks to the proximity of the SG base tunnel. They are projects under negotiation, this possibility was not considered before.</p> <p>*The Helvetic tax policy in relation to the appraisal is lower compared to Italy, Belgium or Germany, making it attractive for some companies to work in Swiss territory and of course in connection with the SG base tunnel, creating a potential market for the development of the logistics and transportation.</p>	*In the case of the future TAV Turin-Lyon railway line, despite the Italian-French agreements, there was limited or inadequate information and participation of the population in the project. Italy and France were unable to have concerted policies or incentives like at the Swiss level for the construction of the Gotthard tunnel and this contributes to less impact.
Contrast question						

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