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Transportation Network Role for Central Italy Macroregion Development in a Territorial Frames Model Based

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Abstract. This paper refers to an interdisciplinary planning research approach that aims to combine urban aspects related to a territorial spatial development with transport requirements connected to an efficiency and sustainable mobility. The proposed research method is based on "Territorial Frames" (TFs) model that derived from an original interpretation of the local context divided into a summation of territorial settlement fabrics characterized in terms of spatial tile, morphology and mobility axes. The TFs, with their own autonomous, different size and structure, are used as the main plot, able to assemble the settlement systems and their posturbane forms. With a view to polycentric and spatial development, the research method allows us to analyse the completeness of the TFs and their connective potential, in order to locate the missing/inefficient elements of the transportation network and planning other TFs essential to support economic and social development processes of the most isolated and disadvantaged inland areas. Finally, a case study of the Italian Median Macroregion configuration based on TFs model approach is proposed, analysed and discussed.

1. Introduction

This paper deals with some issues related to the development of the European space and its territories, with particular reference to equity development, balance of resources, efficiency of settlement and mobility systems and integration of strategies and projects between different regions (coordination / co-planning). These are issues that do not seem to be resolved by the polycentric model referred to the European policies which, being concentrated on cities and networks, tend to overlook the territories and particularly the most vulnerable and critical areas (local contexts / crisis areas) where resources do not reach.

In order to deal with these issues, we propose the use of our method of analysis based on the "Territorial Frames" (TFs) model. This model is derived from an original interpretation of the local territorial context divided into a summation of settlement fabrics, characterized in terms of spatial tile, morphology and mobility axes. The frames are the main plot, with an autonomous and often different size and structure, that can reassemble the settlement systems. Therefore, the TFs are designed as parts of the territory, with peculiar characteristics, delimited by mono/multi-modal transportation branches having different degrees of completeness. The TFs model is conceived and designed to activate an economic and sustainable process of territorial development. In this vision, the landscapes become economic resources able to improve the territorial potentials through the design of an adequate



transportation network for connecting the local requirements to global ones, avoiding the territorial fragmentation.

The research, conducted at the University of L'Aquila, is based on the sequential articulation of three working steps. They are:

1. Definition of the TFs model on a European scale, through the identification of individual TFs based on its settlement system, natural system, productive system, mobility system and city network, within a system vision able to support a polycentric region sustainable development, in line with the cities network European interpretation [1];
2. Integration of the territory interpretative model based on TFs with the Macroregion model [2] (governance instrument of territorial development projects);
3. Application at national / regional scale of the integrated TFs model to the Macroregion model at the same scale, with the aim of analysing the completeness of the TFs and their connective potential, necessary to enable new processes of sustainable development, with particular reference to the inland areas economically disadvantaged.

The analytical method proposed, allows to relate the spatial configuration of the European Macroregions to that of National Macroregions, through the use of the TFs model. In this context, as the scale decreases, the TFs take a spatial role, a quadrilateral shape, with an increasingly dense and tiny fabric able to intercept the 'local' territories and to fully exploit the opportunities arising from the "Global" territories.

The intent is to overcome the conceptualization of planning lines dictated by the EU which is embodied in the polycentrism, in the Ten-T network and the European corridors [3].

So, we want to overcome the pan-European vision derived from different models proposed by the literature on European trends in recent decades, such as the Blue Banana [4] and the Bunch of grapes [5], very impressive from the interpretative point of view but in fact just effective in terms of cross-scalar integration of policies and territories.

Section 2 of this article explains the TFs architecture model with relation to the cities network and the European Macroregion configuration. An TFs model application in the Italian median Macroregion context is illustrated and discussed in Section 3. The concluding remarks are in Section 4.

2. Territorial frame paradigm, cities network and Macroregion concept

The phenomena of deterritorialization and metropolisation lead us to reflect on the role of the territory in the settlement context in the post-industrial era. From the '60s, emerge new urban forms significantly different from those of modern industrial cities, even different for the social geographies model to which they refer. Transport systems evolution break definitively the close spatial relationship between workplace and residence, effectively allowing the decentralization of residential uses in the territory.

The commuting of the suburban population towards the city centre for work creates problems of access and congestion, so that the predominant patterns used for the planning of the city are "road-building". The mobility model "hub and spoke", for which the city centre (hub) is the most accessible point, is consequently transformed into a structured model as a "network" where the branches represent the connection infrastructure and the nodes represent urban centres [6].

These transformations have materially altered the access way into the city-region, encouraging the widespread growth and removing the need to be close to centre [7]. This need, as we know, has kept compact cities throughout the nineteenth century through concentric growth patterns. In Europe, this model of post-industrial period [6] has given back a still vibrant urban core, though often revitalized and reinvented, circumscribed by the suburbs, with major residential expansion surrounded by a mix of other developments such as shopping centres, recreation centres, business parks, etc. These are new forms of settlement, which produced new urban and peri-urban morphologies and that sometimes the planning systems are not able to rule (often urban and territorial planning has been limited to only govern traditional transformation processes). Thus, new settlement meshes emerged, elements that frequently are concentrated along the major infrastructure corridors and around the new polarity extraurbane:

commercial areas with their non-places, agglomerates and industrial districts more or less large and partially unused, large rural areas, etc. Compared to this phenomenon, the urban and territorial planning did not elaborate tools to interpret and govern the processes of formation of the territory and landscapes (see for example the failure of the European Spatial Development Perspective '90s).

The urban and territorial post-industrial reality and related settlement, productive, mobility and natural systems, are interpreted by the European Community through the polycentric model [1], putting at its centre the city networks and concentrating the development policies on the same city (see for example the scenarios of the study "European Territory towards 2050", ESPON [8]). This model, not fully effective for the economic policies and inadequate for those spatial, in recent years in Europe is developing the concept of Macroregion [2] which is a tool for governance of Territorial development projects, which pursues common challenges of the regions that make it up (they are tools that come from below). These are tools with great potential but have some emerging issues represented in figure 1: the complexity of the governance of overlapping areas, the isolation of marginal networks of cities, the complexity of the territories concerned, the variability of the development projects and difference of their interest, but especially the relationship between them and with external territories, i.e. without active or defined Macroregions [19].

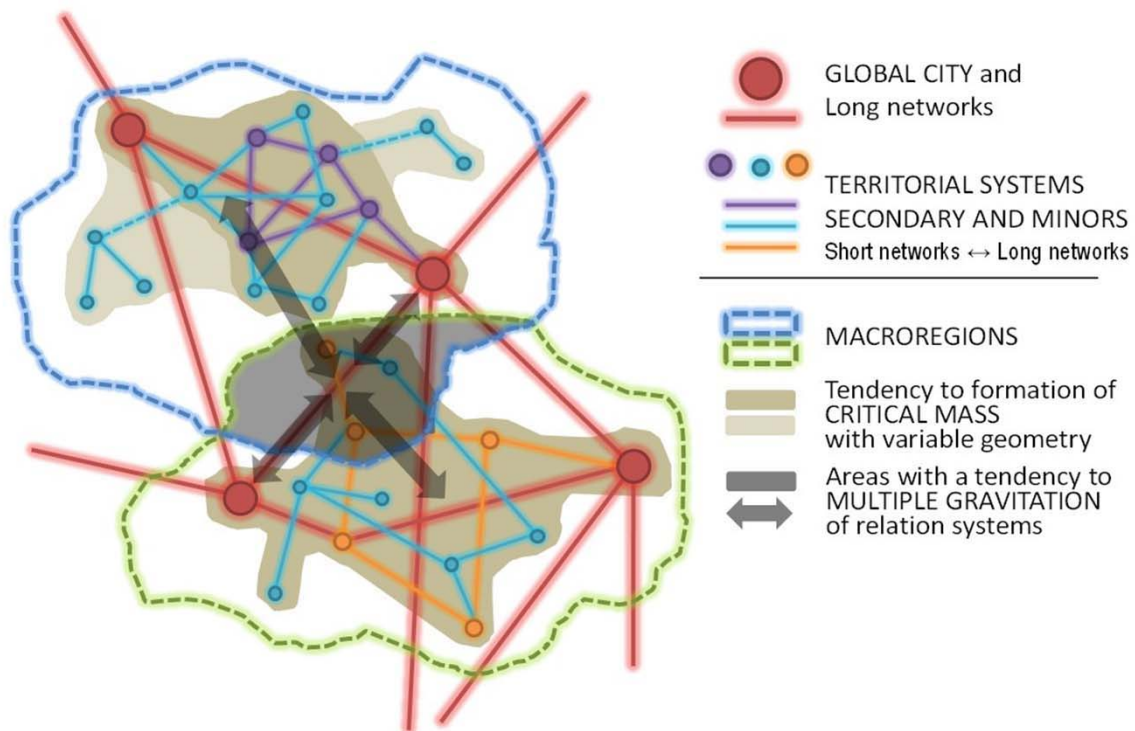


Figure 1. Ideogram of functional relationships within the Macroregions

All these elements, namely the settlement, productive, natural and landscape post-industrial meshes, European unbalanced polycentrism, a macroregionalism devoid of a spatial reference framework, do not allow to achieve the basic objectives for the development of a territory. We refer to issues such as equity, balance of resources, efficiency of settlement and mobility systems, the integration of strategies between different regions and projects. We also refer to the need for a new phase of European spatial planning and of its regions.

Our research addresses these topics and their integration, through an evolution of the polycentric model (based on networks of cities), proposing a new interpretative paradigm that we have defined "Territorial Frames" (TFs). The TFs are spatial tiles (mostly quadrilaterals shaped) whose sides are

constituted by the major European mono/multimodal transport corridors, characterized by their completeness/incompleteness and on which moving flows of goods and people. Along these sides (from now, "branches") and their vertices are the major urban agglomerations and productive and the most important European cities [9]. This can easily be seen in figure 2, in which cities are the Metropolitan European Growth Areas (MEGAS) [1] and the agglomerations are so-called Megaregions, Europe's major competitive areas identified by Richard Florida [10]. We can easily see how the Megaregions coincide with the branches of the TFs. With a darker colour are then represented the branches that coincide with the corridors of the European network TEN-T [3].

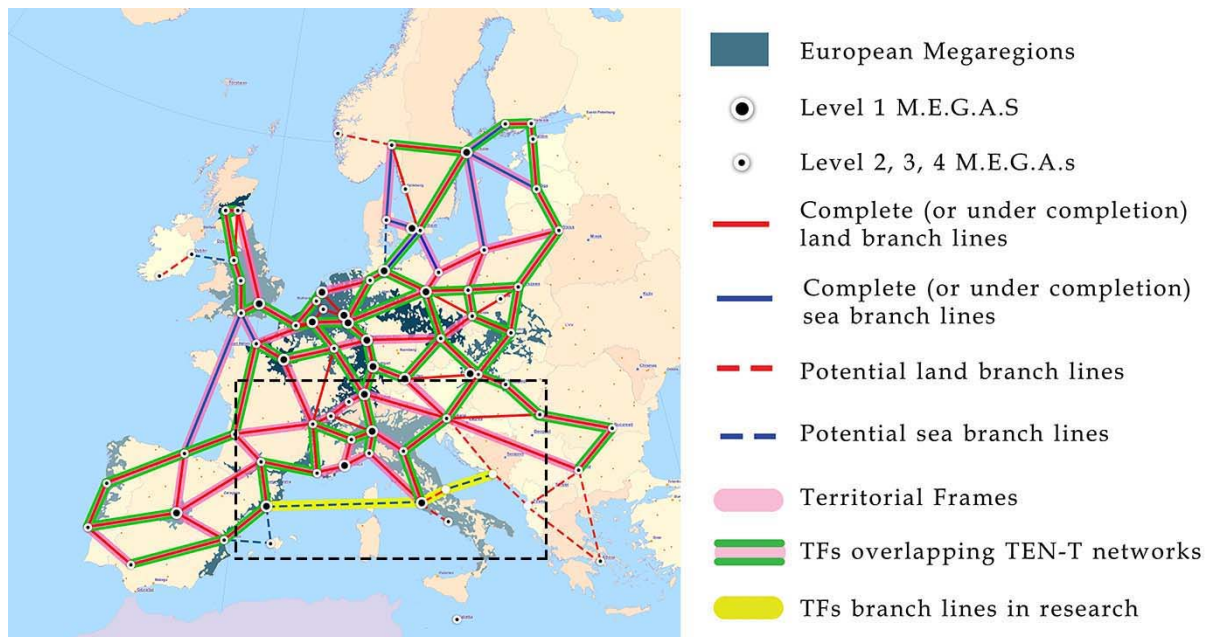


Figure 2. European Territorial Frames (TFs) and Megaregions

In our model, the TFs, with their independent and often diverse size and structure, constitute the main plot that recomposes the settlement systems and their post-industrial forms, and describe a very special settlement both for the extension and for a new hierarchy of the urban centres. The quadrilaterals that compose them are contextualized in the Macroregions and to them are connected the networks of cities (from the global and metropolitan cities up to the medium and small cities). Straddling the quadrilaterals there are spatial tiles constituted by large and small urban areas, from more or less important productive areas, from natural reservoirs. figure 3 illustrates the configuration of the TFs in the contexts of Macroregions. We can recognize the TFs internal to the Macroregions, that therefore support the internal development processes, and TFs straddling the Macroregions which support necessary coordination and exchange processes.

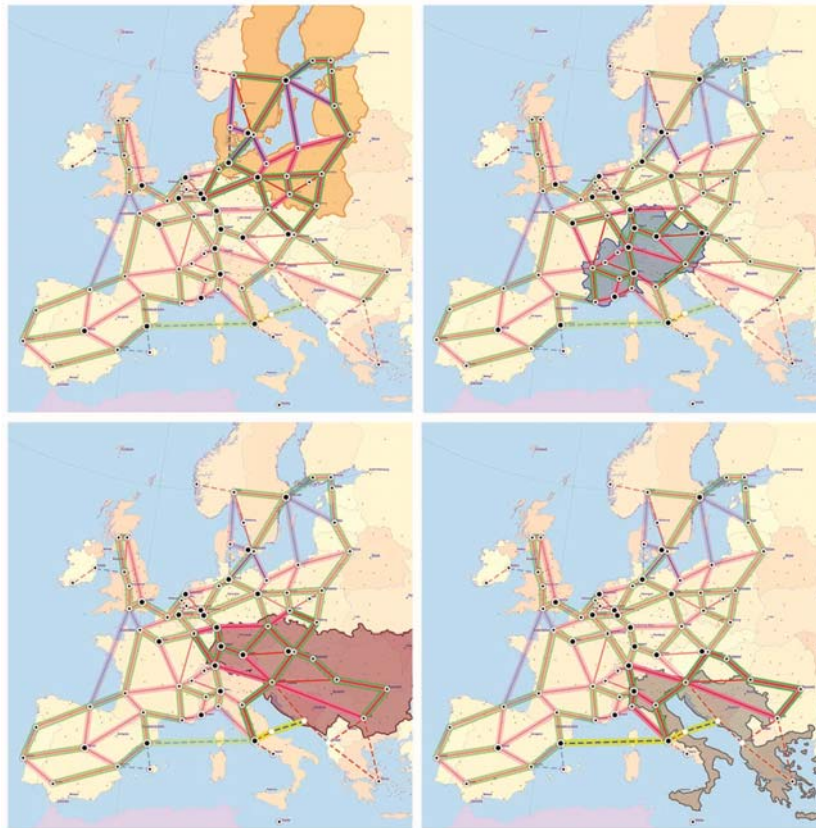


Figure 3. European territorial frames and the four Macroregions activated

3. Italian median Macroregion

In this section we illustrate the application of the TFs model integrated, with the concept of European Macroregion on a national scale. In other words, we want to see if the model of the European Macroregion can also be successfully applied at the national level and if the cross-scalar nature of TFs allows to balance regional development in favour of the "inland areas" [11] or economically disadvantaged/underused areas because of their difficult angle. We also want to investigate the limits of this application.

Regarding the potential of Macroregions at Italian level, and more in general at National level, the issue has already been addressed by a preliminary study, the Territory Project "Joint 2" (Progetto di Territorio "Snodo 2") [12], carried out by the Italian Ministry of Infrastructure and Transport and the Abruzzo Region. This project, using the concepts of European origin, and bringing them back in the national context, has identified, among others, the so-called Median Macroregion [13], a macro-area of central Italy that we believe represents the optimal size and spatial reference for more effective strategies and for the governance of regional and local development projects.

Starting from this element and the results at European level described in section 2, our method of research helped to identify local TFs (figure 4), such as deepening of the large European TFs [13] [14]. The analysis result showed infrastructural quadrilaterals, often incomplete with regard to the connective branches, whose vertices are (not always) historical settlement aggregations, mid-level cities [15] or metropolitan cities (urban poles where are concentrated the higher level and rare service). The connective branches of the quadrilaterals sometimes have created a settlement development of post-industrial type for linear diffusion along the same branches, with an essentially productive and commercial characterization. In contrast, in the inland areas of the TFs are placed agricultural activities, settlements scattered and, often, also natural areas and landscapes of great value, that can be the subject of new forms of sustainable development planning. Figure 4 illustrates the perimeter (black line) of

Median (Italian) Macroregion, the configuration of the local TFs, MEGA and medium-sized cities and industrial districts.

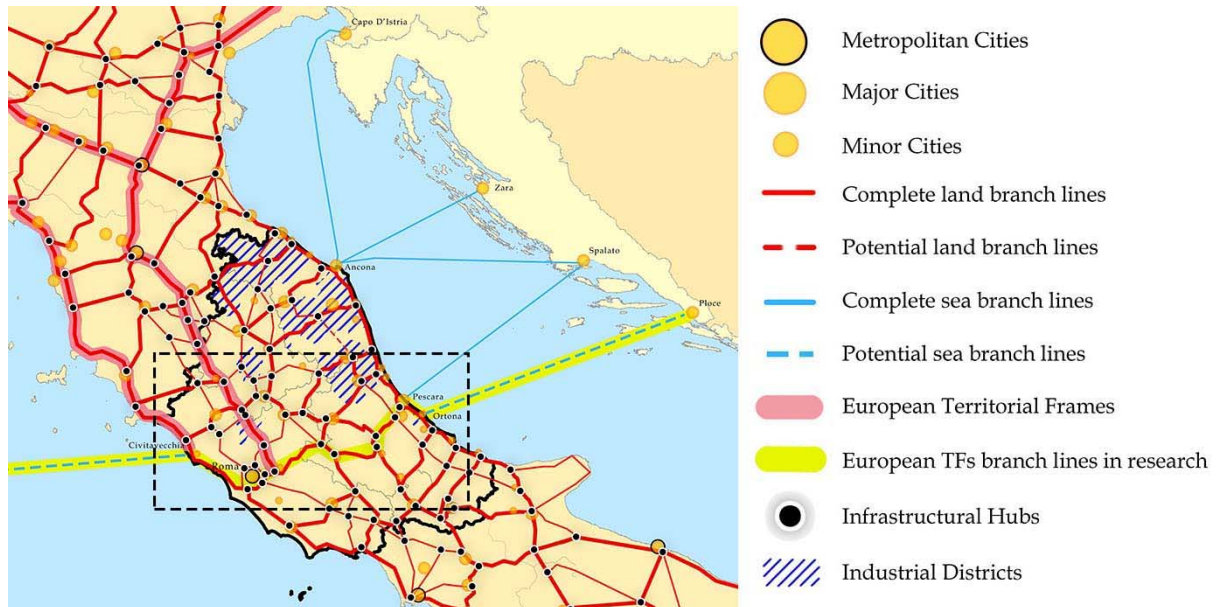


Figure 4. Territorial frames configurations in Median (Italian) Macroregion

The results of the analysis carried out on the local context of the Median Macroregion have highlighted the incompleteness and inadequacy in terms of transportation efficient and settlement structure of many TFs. These characteristics, derived from obvious infrastructural deficit, has had, over time, the clear consequence of isolating and/or marginalizing the more decentralized and weak territories, such as the aforementioned inland areas (underutilized areas and areas of crisis). Consequently, these areas have been excluded from the development processes that in contrast have been concentrated around large cities, from metropolitan to global ones [16] and in more accessible and competitive territories in terms of generalized cost of transport.

Our proposals for strategic interventions necessary to cope with the problems that emerged in the analysis phase, aim to: i) plan the sustainable development in terms of new spatial structure and new territorial policies (including consideration on climate change and the land take issue); ii) support the planning through governance tools such as the Macroregion and through territorial organizing principles based on TFs connective branches with high efficiency; iii) strengthen the network of small and medium-sized cities to connect them to major European agglomerations and benefit fully from their urbanity.

In this way we put in contact the "local" with the "global" territories, we bring in competition all the regions involved highlighting their differences [17], differences that the TFs model uses as an activator of the processes of development. In fact, in the first instance, it's the diversity of the territories that moves people, goods, capital and information [18].

4. The Adriatic-Tyrrhenian link within the network of connections

This section illustrates the application at local scale of the TFs model in which has been analyzed a territorial portion of Median (Italian) Macroregion, whose study area is bounded by the dashed rectangle in figure 4.

The research method used has led to the identification of local TFs configuration, but also the performance analysis of their connective branches. The study of the connections system was conducted in multimodal terms including both linear infrastructure (road, motorway and railway) and punctual infrastructures (freight terminals, ports, airports, etc.) that insist on the territory between the coastal

areas of the Abruzzo Region (East/Adriatic) and Lazio Region (West/Tyrrhenian). In this territorial sector, the settlement, productive and naturalistic systems are currently supported by TFs that intercept a number of crisis areas and peripheral and outermost cities (as identified by the national strategy of the inland areas [11]). The interconnection branches are mostly constituted by a road network often overloaded, a motorway network that supports almost all of the flows crossing (passenger and freight) and a nineteenth-century conception rail network, inadequate in performance, empty and underutilized. From the point of view of settlement, network branches connect the conurbation of the Adriatic coast and the metropolitan area of Rome, the respective ports, airports and freight terminals.

The existing east-west corridor consists of the motorway link (A24 and A25) supported by a railway line (Pescara-Roma along about 240 km) with a very low level of service, with a very low traffic and very high connection time (from 3 to 4 hours). In contrast, it intercepts one of the historic, natural and landscape heritage most important of Europe, large areas devoted to agriculture (Fucino basin), and significant industrial areas located not only on coastal areas (Pescara and Rome) but also on the inland areas (Avezzano, Sulmona and Carsoli). As a result, the movement of people and goods are made, mostly through the motorways A14, A24 and A25.

An extreme example, but significant of the existing relationship between the service performance related to different modes of transport on iron and on rubber, is provided by the connection times (O-D) between Rome and L'Aquila (the capital cities of the two neighbouring regions). In this specific case, the shortest rail route (via Sulmona) implies extremely low daily frequencies, connection times not less than 2 hours and 40 minutes, and traffic flows that are basically null. In contrast, the stretch of motorway A24, which connects the two cities, supports a volume of traffic more than 5 million trips per year, helping to generate, especially in correspondence of the peak hours, congestion of traffic, especially in the proximity of the city Capital (Rome).

5. Proposal, results and discussions

The analysis results illustrated in section 4 showed that the weaker territorial sectors in terms of socio-economic views are largely supported by incomplete/inadequate TFs. In this case, the settlement and transport infrastructures systems have performance deficits accumulated by a long period of absence of spatial and territorial planning. We also observe a number of critical issues such as: empty industrial areas, commercial areas and new centres located in highly congested areas, the system isolation of ancient villages, a disorganized logistics of the transport, territorial imbalances between coast, hill and mountain.

The project proposal (figure 5), which originated from the research, aims to strengthen and/or complete the texture of the connective branches of TFs and, simultaneously, to create a preferential mobility corridor (east-west) based on multi-modal transportation system.

The proposal covers transversal issues such as: i) environment, which helps to reduce traffic emissions and thus to achieve ecological sustainability; ii) social, because it promotes the quality of life and territorial accessibility; iii) economy, which reduces the costs of transport and favours the economic and productive development of marginalized areas; iv) operativeness, which puts into play, tools and processes of technical, organizational, and financial type.

The actions to be pursued in a medium to long term scenario, mainly concern the following aspects:

- a) Performance enhancement (with typical Italian high speed network characteristics) of the actual transverse director (Pescara-Roma) with the intent not only to connect the two cities but to systematize the most significant airport and port that insist on the Abruzzo and Lazio coastal territory. The functional enhancement of this corridor assumes strategic value if also considered as potential transverse axis of cross-border link (Balkan area to the East and West Europe) to support in multi-modal terms the maritime transportation network that, in the near future no longer be postponed, should be based on the development of so-called "sea motorways", whose articulation will focus mainly along the north-south and east-west direction of the Adriatic and Tyrrhenian seas.

- b) the creation (from scratch) of a railway line intended to link the city of L'Aquila with a middle station of Pescara-Roma direction (view the previous point). In this case, L'Aquila, exploiting its barycentric location, could be connected to two reference cities (Rome and Pescara) with a short time (of urban type). In a long-term scenario, the link in question could possibly be extended up in the province of Ascoli Piceno with the intent to intercept an important productive district.
- c) functional redevelopment, mainly directed to the enhancement of the landscape, historical and environmental heritage of some inland routes of the Apennines (Terni-Rieti-L'Aquila-Sulmona-Carpinone), characterized by low demand and mostly mountain tracks.

The collection of interventions is aimed at realizing the functional integration of the above realizing lines, a rail link network capable of ensuring OD times of urban type, in such a way to conceive the territory between the two seas (Adriatic/Tyrrhenian sea) as polarized metropolitan area within a single context, historically and culturally qualified and partly environmentally protected; all in compliance with the strategies of territorial integration sought by the European Union.

The strategic interventions proposed, in addition to making efficient some transportation branches of TFs in the central zone of Median Macroregion, contribute to the functional integration between the east-west (Adriatic and Tyrrhenian corridors) and north-south rail branches (Tyrrhenian Corridor, Adriatic Corridor and Apennines Dorsal) realizing, in fact, a connecting network to cover the entire area of study.

In a territorial context such as that of Median Macroregion, where the most significant centres are located on average 60-100 km between them, a high-speed rail system makes it possible to make direct connections with times of about 15-30 minutes and connections Origin-Destination within one hour. In this way, the connections as Rome-Aquila or Rome-Pescara in terms of time can be compared to an urban-type movement, extending in fact the metropolitan area of Rome to the Adriatic cities of Abruzzo and taking full advantage the system of central Italy TFs. In this logic, the inland areas, notoriously penalized as compared with Coastal reality, would be an advantage from the point of view of the average connection time as they have a barycentric position with respect to the geographic conformation of the peninsula.

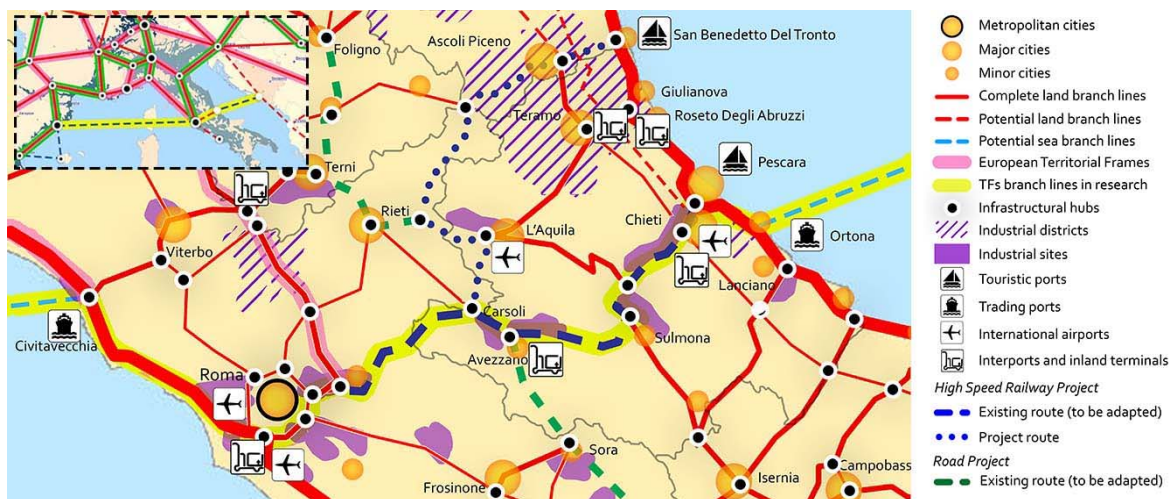


Figure 5. The Adriatic-Tyrrhenian multi-modal link and the Apennine dorsal (at the top left, a detail of European TFs, as in figure 2).

Recovering the areal/regional paradigm and combining it with the polycentric paradigm, the research call into question the effectiveness of Macroregional model, and has verified their full potential in the absence of connective branches (transportation infrastructure) capable of conveying/distributing flows

and to convey these flows (not just cross) even in the most depressed economic contexts. The territorial support structure that is proposed is that of Territorial Frames (TFs). The research has identified a general configuration at European level of TFs and a more detailed national (Italian), recognizing the limitations of these in the completeness and lack of connection with the settlement, production and the landscapes systems.

The paradigms of the Macroregion and Territorial Frames seem to respond to the need for new planning models and European territorial development models. The research results presented in this paper, although preliminary, show that it is possible to conceive a new model of interpretation of the European space, a recomposition pattern (represented by TFs) of settlement systems and their post-industrial forms. The TFs are spatial tiles shaped in relation to the mobility flows and the territorial morphologies on which are distributed the cities networks and Macroregions. It is a new interpretation that substantiates a planning mode, more consistent and adapted to the current socio-economic models, which tends to reach the main objectives of European strategies (such as those of the Amsterdam pact for the EU Urban Agenda) including the circular economy, sustainable land use and energy efficiency, mobility, quality of life and equity.

6. Conclusions

In this paper were presented the preliminary results of a multi-disciplinary research that aims to integrate questions of planning of the development of European and regional space with mobility needs, exceeding the conceptualization of the EU that is embodied in the polycentrism, the Ten-T network and the European corridors.

The proposed research method is based on "Territorial Frames" (TFs) model that derived from an original interpretation of the local context divided into a summation of territorial settlement fabrics characterized in terms of spatial tile, morphology and mobility axes.

The TFs model has been developed and applied in multi-scalar format at European, national and local context, with the aim of articulating a new approach to analysing and planning based on the Macroregion paradigm.

The research results, although preliminary, have allowed us to positively verify the methodology of analysis and planning approach through:

- The definition of the TFs model on a European scale.
- The construction of a TFs model integrated to economic and territorial configuration of the great European Macroregional areas.
- The application at the national/regional scale, the TFs integrated model in favour of economically disadvantaged inland areas.

The result showed the univocal correlation between incompleteness/inadequacy of TFs (in terms of mobility and settlement systems) and the location of economically disadvantaged areas. Through the use of TFs model, the study also provided a project proposal, on a local scale, regarding territorial and mobility structures of the Median Italian Macroregion. An east-west multi-modal transportation system corridor has been proposed in order to realize a strategic axis of cross-border link (Balkan area to the Est and West Europe).

The next step of the research will concern the testing of the territorial and urban spatial planning based on the TFs model with particular reference to transcalarity and optimal territorial dimension, and with reference to the study of new governance models aimed to territorial equity.

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