

Connective infrastructures as transnational articulators

Trans-scalar Analysis of three European Union borders

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Introduction

More and more States are setting aside their geopolitical differences to find new ways of dialogue and methods of cooperation for the common interest, in order to offer a more competitive global position, allowing transnational integration in two dimensions: the physical and the virtual. The physical dimension refers to the maritime-territorial geographical articulation that occurs through physical movement and exchange, which directly impacts natural and urban systems. The virtual dimension, on the other hand, involves the regulatory and conceptual openness of the States involved, developing an institutional and legal articulation, creating binational or supranational entities to cooperatively manage and administer the exchange, which directly impacts the socio-economic, commercial, and cultural level in both directions. However, several neighboring States have not yet managed to overcome border conflicts, as their solutions have been inclined to address only one dimension, the physical or the virtual, without envisioning a comprehensive solution. For its part, the E.U. is an expert on this issue and has made considerable progress in transnational cooperation programs, improving communication between its States, and blurring their borders, allowing for a peaceful environment.

This article aims to describe and assess the application of infrastructure networks for connectivity and urban articulation as effective tools and methods to generate transnational cooperation and territorial cohesion between States that have historical conflicts, in order to understand how, through the integrative and territorial support capacity of infrastructures, a multi-scale impact of the spaces divided by international politics is produced, both on the physical and virtual planes.

It is proposed to highlight connective infrastructures as tools of great impact due to their vocation of territorial support and their articulating capacity, which enhance the integration and cohesion of territorial systems that are not linked at a multi-scale level, which would make it possible to encourage transnational cooperation programs for the

exchange between States that have historical border conflicts. For this purpose, a multi-scale analysis of three case studies will be carried out, which will make it possible to verify and evaluate whether the application of these connective infrastructures has the sufficient operational and functional capacity, which equates to the necessary territorial cohesion mechanisms and the logistical-functional sufficiency to produce a re-connectivity of geographic systems that have been abruptly divided by international conflicts. The three selected cases affect and modify transnational dynamics through the application of connective infrastructure for cooperation at the multi-scale level, each representing a successful process that has overcome historical conflict and is still in operation.

An inductive methodology is used, which seeks to test a system or theory based on the observation and analysis of specific cases. It begins with a conceptual theoretical approach, which explains the multi-scale function of the territory and the relationship of the systems that converge transversally at each study scale, developing a structured evaluation of the three cases: The Rhine River fluvial-commercial waterway, the Gabčíkovo - Nagymaros dam system, and the Basel transnational urban system. In each case, the management model, the regulatory and administrative adaptation, and the virtual integration are analyzed, as well as the spatial and functional response elicited by the exchange, managing transnational cooperation of effective and multidirectional exchange, otherwise a physical integration. Prior to the conclusions, a subchapter is developed that brings together the management and methods of joint application of the three cases. Finally, the conclusions group together the main points of critical value and the specific elements that lead to the evaluation of infrastructures as an effective tool for transnational cooperation [Fig. 01].

Theoretical and conceptual discussion

The logic of the multi-scale functioning of the territory is understood as the various levels of relationship and connection in the operation of systems, networks, organizations, and mechanisms, physical or virtual, that interact and impact the geography. Additionally, it performs a continuous assessment of the systems that integrate it through the superposition of information and the overlapping of actors at different spatial scales, generating an influence from the global scale to the local, urban and infrastructure scales, the latter being where the immediate exchanges of the human being take place, transcending the concept of scale that reinterprets the physical size of an object on a smaller or larger plane of reality.

Political geography delves into the multi-scale behavior of the territory and the relationships between the systems that compose it. The Englishmen Peter Taylor and Colin Flint¹ propose three main scales of study. The first is the “local scale”, that of experiences and social interferences, where direct human links are developed, typical of municipalities or cities. The second is the “political scale”, the most mediatic, known as the State or ideological

scale, where the ideological narratives of a Nation are constructed. The third, the “scale of reality”, is that of globalization and geopolitics, where politics becomes a confrontation of interests; this is the most decisive scale, it is the scale that conditions the other scales and social life, and where a set of power relationships impacting the rest of the scales is established (Taylor & Flint, 1994).

For his part, the Frenchman Yves Lacoste goes further, and proposes six territorial scales of spatial analysis of the relationship between states called “Magnitude Orders”². For Lacoste, a large part of geopolitical problems is due to the role of external alliances and international treaties, which are determinant for national or regional policies. He invites us to understand conflict and alliances from a multi-scale study of the territory, where the impacts of infrastructures that articulate cross-border territories are perceived. These are understood as the superposition of cartographic planes that represent the various systems, networks and components that intervene at different approaches [Fig. 01]. Lacoste warns that it is more complex to consider the interactions between the six “Magnitude Orders”, but that, thanks to globalization, and especially to the progress in communication technologies, and in energy and transport connectivity infrastructure, these interactions between scales are increasingly faster, more evident and more efficient, altering the international relations we have known since the 20th century, causing a change in transnational dynamics at a global level³. This classification is a determining parameter for the selection of the three E.U. case studies, corresponding to the third, fourth and fifth magnitude order, which, because of their impact on physical and virtual dynamics, have transcended from the global to the local scale (Lacoste, 2008).

Case Study Analysis

Case 1: “Fluvial Waterway of the Rhine River”:

The Rhine River is the main protagonist of commercial exchange in Western Europe; it has contributed to the development of industrial cities such as Rotterdam, Dusseldorf, Cologne, Strasbourg and Basel, cities with powerful economies developed thanks to the commercial routes of cargo ships using this main connectivity route. As a result, it was the focus of geopolitical tension during World War II. Today, inland waterway transportation logistics has been promoted by international discussion forums as the most efficient, viable, sustainable, and safe means of transportation⁴, helping to reduce risks and better control the safety of the sector [Fig. 02].

Physical and virtual integrations

This case raises tangible solutions to achieve a “navigational freedom”⁵ of the river, thanks to an infrastructure adapted for accessibility that ensures the continuity of natural and urban systems, a conflicting issue at the beginning of the 19th century. Thanks to the signing of balanced international treaties and conventions, a collaborative environment was generated to promote the common goal of using the river as

an axis of commercial connectivity under the concept of “navigational freedom”, agreeing on a unified form of commercial navigation that incorporates several dimensions and is linked to the rights perceived by the different territorial and political administrations (States) involved in the commercial dynamics of the river. Through the *Final Act of the Congress of Vienna*⁶ (FACV), it was possible to eliminate economic and physical impediments, such as tolls or barriers that prevented free commercial passage through the river axis. This meant that the State territories bordering the river gave up part of their sovereignty for the common good⁷.

The FACV document constituted a permanent binding relationship for all riparian states to ensure the benefits of all others, with regard to “navigational freedom”, related to the trade of goods. It also required the creation of regulatory bodies for each of the various European rivers called “Commissions”⁸, a kind of supranational entity necessary for the coordination of work, which controls and establishes rules to guarantee and commercially promote the use of the Rhine. The Commissions optimize the existing customs procedures and, as the security authorities of the States remove the physical barriers hindering the passage of cargo vessels, speed up a smooth passage. With the creation of the *Treaty on European Union*⁹ (TEU) and the *Central Commission for Navigation on the Rhine*¹⁰ (CCNR), a solution has been found to many existing diplomatic and international management problems. Cities have been developed through the production of supporting infrastructure networks, such as river access roads, road and natural connectivity tunnels, ship maintenance platforms, industrial, control, assistance, and maintenance ports, as well as - airports serving border cities, such as Strasbourg [Fig. 03] and Basel. In this way, the EU and its institutional bodies have achieved lasting political peace and stability as well as commercial prosperity.

Case 2: “Gabčíkovo-Nagymaros Dam System”:

The border between Slovakia and Hungary is marked by a project that caused one of the biggest European geopolitical conflicts at the end of the 20th century. The project is comprised of three reservoirs, two hydroelectric plants and two discharge canals along 170 km of the Danube riverbed. Inadequate processes in the construction of the infrastructure and negligence, since no prior environmental studies had been made, caused the geopolitical conflict. A conciliation procedure before the International Court of Justice in The Hague (ICJ) was required. Currently, this system is in operation and the conflict has been overcome [Fig. 04].

Physical and virtual integration

The project was promoted with the *Budapest Treaty of 1977*; it was developed under the international political framework of the Cold War, where both States were part of the Council for Mutual Economic Assistance (COMECON); therefore, it occurred in an environment of homologous dialogue, promoting infrastructure projects that would integrate economies for the common good. Hereby, both governments

agreed to intervene the course of the Danube River, stimulating the economic development of neighboring communities with a renewable source of electricity; however, environmental impact studies were not performed, and there was no clear knowledge of the real cost of the project, a situation that aggravated the bilateral relationship. The conflict worsened in the 90s as, with the fall of the Soviet Union and the dissolution of Czechoslovakia, the priorities of both countries changed and the environmental impact on the river became evident. Although Slovakia proposed different variants of the project for the Hungarians to advance in their territory, the latter kept silent, which led the Slovaks to propose a “Solution C”¹¹, where the entire work would be carried out within Slovak territory, channeling and diverting the waters of the Danube River. Upon its completion in 1993, the first consequences of the environmental impact became evident, initiating the long process of lawsuits in the ICJ.

Given this situation, both States were ready for an open dialogue to solve the conflict and, in May 1995, the *Treaty of Friendship between Slovakia and Hungary* was signed with the aim of finding common ground and a solution. Slovakia recognizes the ecological problem and environmental impact, and it agrees to stream 400m³/sec of water on the original Danube riverbed¹², improving the environmental outlook, trust and tolerance between the parties. In 1997, the ICJ considered that the *1977 Budapest Treaty* was in force and governed the relations between the two countries accordingly, and that Hungary acted improperly by arbitrarily abandoning the project. Today, both nations have initiated a process of dialogue, through a new diplomatic meeting that considers the necessary interventions and measures to promote the achievement of common goals. Thus, Slovakia proposes to redefine the line to be the navigable midpoint of the river. They promote the adequacy of new infrastructures and interchange spaces, generating continuity in their border systems. Currently, they continue to propose joint transnational infrastructure projects, such as the bicycle bridge and bike-sharing system proposed by the *European Territorial Cooperation* (ETC) within the *Interreg Program*¹³ in 2020.

Case 3 “Basel, Triple Transnational City”:

The transnational city of Basel functions as a single open urban system together with the German sector of Weil am Rhein, with an industrial-housing vocation, and the French sector of Saint-Louis, with a commercial-residential focus and where the Euroairport is located. This triple border system has an effective integral articulation, in which each of its urban centers has a vocation and a functional role within the large transnational urban core [Fig. 05]. Switzerland is the fourth E.U. trading partner and thanks to the *European Free Trade Association* (EFTA), being part of the ETC, and managing the *Treaty in the Preferential European Economic Area*¹⁴, it has achieved the free movement of people and goods.

Physical and virtual integrations

Its three integrated urban systems achieve an uninterrupted permeability of flows,

through new ways of spatial cooperation in its neighboring areas. EU-driven territorial cohesion efforts have developed international programs to spatially intervene in their borders. With these strategies, cross-border strips are no longer conceived as residual spaces or peripheral areas, but are included in a program of action and urban development, qualifying as areas of future development or natural conservation, an indispensable method for guaranteeing exchange and promoting synergy between transnational municipalities. One of its main achievements was the creation of the Basel-Mulhouse-Fribourg Euroairport, located on French territory, but operating openly for the three urban systems, linked to the tramway system and river freight ports.

The *Regio Basiliensis Program* in 1963 and the *Regio du Haut Rhin* in 1965¹⁵ were the first impulses to transnational cooperation already focused on constituting this region as an integrated urban area. They were the basis for projects that served as regulatory support for progressively more cooperation programs in the 1970s. In 1985, the *Freiburger Regio-Gesellschaft* program helped to consolidate this area as a Euroregion of transnational political-economic cooperation of great interest, based on the industrial and commercial potential of the Rhine River transport. These cooperation impulses under tri-national projects were given with the effort of joint public-private action at the municipal level.

In the 1990s, with the ETC, a series of infrastructure projects for the integration of transnational urban dynamics were promoted; one of these programs was called the *Tri-national Agglomeration of Basel*¹⁶ (TAB), in 2001. This project gave rise to the concept of “*Common Development in the Integrating Areas*”¹⁷, which identifies relevant and priority projects for the three integrated urban systems, promoting the TAB¹⁸. The effects of this process have encouraged transnational cooperation programs between municipalities, generating new jobs in the field of innovation and SMEs, granting *Structural and European Investment Funds*¹⁹, and galvanizing the field of the low-carbon economy²⁰. Also, the creation of the “*European citizenship*” has allowed the inhabitants of the States to move and reside freely. This led municipalities, public institutions, social groups, and private companies to serve as promoters and generators of programs that transcend administrative boundaries, integrating public services such as waste management, health, emergencies, public transportation, public safety, education, and natural conservation.

Cross-cutting guidelines - Criteria to be extrapolated

Administrative-Institutional Management:

It is essential to propose a joint administration of transboundary natural resources, including water, natural reserves or mountain areas, through binational or supranational administration entities. These could reproduce the good functional practices of the Commissions -Rhine River-, or the Friendship Treaties -Danube River-, adapting their management models to guarantee free

exchange, free navigation, free transit, and integral security. The structural and financial platform of the *Interreg Europe Program* has been indispensable to promote transnational cooperation projects where infrastructure has been consolidated as the tool to carry them out.

Public-Private Management for economic promotion:

The joint work and impulse between private companies and public institutions is necessary to achieve these synergies, under integral management of the urban development plans of the cross-border municipalities, considering projects that assume and intervene in the local areas, based on the real needs of the different urban areas, and consequently impacting at a multi-scale level. Therefore, there must be a strengthening of the internal institutional apparatus of those States that require it, so that the binational or supranational administrative entities that are proposed achieve results that guarantee democratic stability and lasting peace between the States involved.

Sociocultural Management -Belonging and identity:

Guaranteeing free navigation and free transit, both commercial and migratory is indispensable. Connectivity infrastructure serves as a support to produce and promote these dynamics. States must understand the advantages of “ceding sovereignty” for the common good, a method promoted since the origins of the E.U. as, in order to obtain territorial peace and to possess integral sovereign rights, it was necessary for nations to transfer and merge part of their sovereign rights, with the purpose of ensuring a common political and economic activity for the integration and development of common resources, and for the establishment of a democratic social system, as well as for freeing men from any kind of slavery or economic insecurity, with a democracy intended to protect against the exercise of the arbitrariness of power²¹.

Joint territorial and infrastructural Management:

In each case, infrastructure has acted as a protagonist to materialize integration, serving as a physical and virtual catalyst for borders. An infrastructure adapted to provide accessibility and continuity to the system must be planned jointly, responding to the special and functional needs of the States; this management has been effectively achieved at the trans-municipal scale. This approach can be extrapolated to other transboundary contexts with hydrographic and mountainous axes, proposing connective infrastructure that, more than connectors, serve as meeting points for economic, social and cultural exchange [Fig. 06].

Conclusions

Connective infrastructures, due to their neutral and apolitical condition, optimize the functional and operative connections that have been discontinued at the borders, devaluing the notion of boundary, serving as

an administrator and articulator of territorial systems. It provides a geographic support system for the management and production of meeting and exchange spaces at places of conflict or political tension. With this, the infrastructure promotes a reciprocal exchange in the relationship between States.

The planning of connective infrastructure and the re-articulation of transnational urban networks have served as an effective method and tool for executing transnational cooperation programs, the materialization of which was previously unclear. International organizations such as the E.U. have understood the vocation of infrastructures to guarantee the continuous flow of trade and people, linking the territory physically and virtually, and transcending the paradigms of international politics, configuring continuous territorial and urban systems that function as a single body at different scales.

The logistical-functional articulation of the systems that operate the territory is more effective and integral at the “trans-municipal” scale. As it is an “intermediate” scale, infrastructure acts and impacts better there, where the dynamics of large urban agglomerations and the more direct relations of urban centers with their movements are patent. It is where the disjointed areas can be better identified and intervened, impacting from the local to the global²². This corresponds to Lacoste’s 4th and 5th orders.

The physical (spatial) and virtual (regulatory) mechanisms detailed in the study cases have promoted a comprehensive transnational opening, driven by the demand for trade and people flow, where connectivity infrastructure serves as a spatial catalyst. It is possible to extrapolate and adapt some strategies used in the E.U. to other political and geographic realities. The study cases represent different management paths and conceptual frameworks, which clarify the lines of action and mechanisms for successful transnational cooperation, reinterpreting international relations through infrastructure, urban planning and architecture itself.

Both levels of integration - physical and virtual - involve a transformation and a rethinking of the concept of sovereignty. It is necessary for the States involved to cede “sovereignty”, both physical-territorial and virtual-legislative, to achieve a synergy, which is materialized through infrastructure networks, without infringing the autonomy of the State, ensuring that the infrastructure fulfills a spatial function as a “State of Exception”, through its neutral and apolitical condition, which integrates systems and flows.

Biography

Luis Alonso Pérez is an architect from Costa Rica. Between 2018 and 2022 he studied the MSc. in advanced architectural projects at the Polytechnic University of Madrid (ETSAM-UPM), the MSc. in Geography in Territorial Dynamics and Urban Development, and the MSc. in International Politics in Sectorial Studies and Areas in Conflict at the Complutense University of Madrid. He is a PhD

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