

CROSS-SECTORAL

# Three theses on the internationalization of infrastructures

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**Infrastructures become more intertwined, with time, on an international level. This has important consequences on infrastructure technologies, corporate organizations and economic institutions.**

What are the economic effects of the internationalization of infrastructures? It is a matter of fact that infrastructures, through the interconnection of technical components, run over state boundaries at continental scale for most of them and, for telecommunication and airway, at an intercontinental one. Hence telecommunication operators are routing calls, worldwide, through satellites and mostly cables. In the same fashion, water basins cover geographic areas that overlap national territories, a situation which requires coordination in flood protection and in the use of water for drinking and energy.

Moreover, infrastructure services have become increasingly provided, at least since the end of the nineteenth century, by multinational corporations and international holdings. Some operators broaden their international services by making agreements with foreign operators. Others, with a take-over strategy, make the acquisition of foreign competitors. Firms have adopted these strategies very early in telecommunication and energy, and, more recently, water and sanitation.

Finally, international bodies are governing infrastructure industries, thanks to instruments such as international conventions and treaties or transadministrative arrangements. These bodies agree on standards for technical interoperability; they determine the clearing system for tariff compensation; and they adopt the formal legal rules for the operation of infrastructures. Before addressing the question about the effects of the internationalization of infrastructures on the economy, I will provide a definition and a brief historic.

## Definitions

Some authors, looking at these phenomena, speak of transnationalization (Carreras, Giuntini and Merger 1994; Vleuten and Kaijser 2006; Clifton, Comín and Fuentes 2007). By this, they refer to the extension of economic activities beyond national boundaries. This notion encompasses importation and exportation, as well as establishing

components of the firm abroad. Indeed, both transnationalization and internationalizations describes the process of increasing economic exchanges across boundaries. The difference, however, is that internationalization also means that it affects several nation-states, and that some of them constitute groups, with two or more members, to handle the effects of economic exchanges across borders.

Alternatively other authors speak of globalization (Mattelart 1996; Lyth and Trischler 2004; Schot 2007). By that, they refer to economic production and consumption that takes place in networks of exchanges on a world-wide scale. This notion does not apply to all infrastructures, because most of them are subject to strong regional characteristics. Whereas telephonic networks have been globalized, electricity grids remain, at best, continental in scope. In a nutshell, if not all infrastructures have been globalized, they were, more certainly, subject to internationalization.

## History

Internationalization of infrastructures has evolved over the long-run – we tend to forget this by thinking it is a contemporary phenomenon – and, since the twentieth century, it has most likely increased in intensity. It has begun, for most of infrastructures still in use today, approximately at the mid-nineteenth century with the increase of technical interconnection. In this respect, telecommunication and energy have been most of the time in advance to other sectors by having a tendency towards globalization. The advent of multinational corporations, at the turn of the twentieth century, has contributed to an increased internationalization at the organizational level. And European states with a colonial enterprise, France and Great Britain for example, have also set up communication and transport infrastructures up to Asia and Africa to govern political and economic affairs from their metropolis.

International governing institutions on infrastructures were, however, incepted mostly from the 1920s onwards with a dramatic increase in the period following the Second

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World War (Henrich-Franck and Tölle 2009). During the nineteenth century, nation-states were establishing trans-administrative governance structure, such as the Central Commission for the Navigation on the Rhine, active from 1831 onwards, and the International Telegraph Union, created in 1865. The Leagues of Nations, which existed between 1919 and 1945, created a transadministrative committee that oversight telecommunication. Its successor, the United Nations, incepted in the aftermath of the Second World War, has created a governance structure in transport. These institutions contributed to an harmonization of technologies, operations, tariffs and legal rules amongst countries.

In Europe, a few institutions were in place to handle the growing internationalization of infrastructures well before the advent of the European Union (Schipper and Vleuten 2008). Indeed technological systems of infrastructures for transportation, telecommunication and energy, by crossing borders through interconnection to cover the continent, required specific institutional arrangements as early as the nineteenth century. Indeed an large number of international bodies, with the label international conference, association or union on a given infrastructure, were indeed limited to Europe in their scope. Institutions have been created during a first wave in the 1920s, as a result of the intense cooperation between European states after the First World War. A second wave occurred during the 1950s, before the advent of the European Economic Community, in 1957. Most of these structures were based on intergovernmental arrangements. Today the internationalization of infrastructures continues in the context of a liberalized economy, and has important consequences on infrastructure technologies, corporate organizations and economic institutions.

### Technology

Internationalization of infrastructures can be understood from the viewpoint of network economics. In this respect, an infrastructure corresponds to a set of technical components, a physical network, that allow a supplier to deliver a service to consumers (Curien 2005). Examples are the provision of services in telecommunication, transport and energy. Corporate and public organizations operate large-scale technical systems that deliver these services. Since the production chain requires the input of several agents, it is coordinated through institutional arrangements. In terms of finance, an infrastructure has strong asset specificity and high sunk costs. Besides, it often requires regulation of the markets, on tariff and network access for example, to guarantee competition.

What are the economic impacts of the increasing net-

work interconnection and interoperability of infrastructures? Technological innovations offer opportunities for far more efficient technical control, management and operation of networks across borders. For instance, operators use information and communication technologies for traffic control systems of airways and railways. Several innovative high-voltage cables run under the seas to connect countries. International standardizing bodies, such as the International Standardizing Organization and the Institute of Electrical and Electronics Engineers, have to decide upon standards to ensure the interoperability of new infrastructure technologies. The absence of standardization can hinder, up to a certain extent, the internationalization of infrastructures. For example, several types of locomotives cannot ride on neighboring countries lines powered with a different electric voltage, unless they have a current converter.

About technology, standardization of technologies remains paramount to have effective economic exchanges across borders. Interoperability corresponds to the capacity of technical systems to work altogether, despite that they fall under the control and command of different operators. It allows uninterrupted flows of persons, goods, information and energy. Infrastructures require, hence, agreements on standards for its full deployment across borders. It comes particularly to the fore with new technologies at the stage of diffusion. Smart grids, whose diffusion has just begun, will fully deliver their benefits if an international body agrees on basic standards for its conception and operation. The internet has already been standardized. Yet, with the rapid spread of information and communication technologies, the international community is continuously adopting new standards, such as the implementation of the internet protocol version 6, to allow the continuation of the world-wide interoperability.

### Organizations

The notion of internationalization can also be studied with the transaction cost perspective on the multinational firm. Several multinational firms are expanding their activities abroad, because they can reduce the number of transactions by vertically integrating intermediate products and services providers (Buckley and Casson 1976). Hence internationalization refers to the process by which firms increase their production and market activities across national borders. By integrating most of the transactions under hierarchical control, these firms hope to get advantages from increasing economies of scale. It requires that operators lay down infrastructure networks abroad to reach consumers. Alternatively, they can create joint ventures or make strategic alliances with firms that already own infra-

structures abroad. Finally, several international activities in infrastructures are supported by flows of capitals coming from international investment banks and financial funds.

What are the effects of the internationalization of infrastructures on industrial organization? Private infrastructure firms are evolving into multinationals by developing global business strategies. For instance, energy providers initiated international exchange of electric power as a back-up facility in case of failures of national power supplies. Nowadays international trade of electricity gains increasing economic importance, which is accommodated the evolution of international market arrangements and multinational market players. Other sectors become also increasingly internationalized. Airway companies create alliances, merge or establish consortium to extend the world coverage of their routes. Telephonic operators start to offer communication and data services to costumers outside of their national borders. Some industries, despite the liberalization of the markets, took more time to internationalize. For example, railway companies tend to serve their national market, because they remained largely owned by the state or under its direct control.

Regarding organizations, we make the observation that firms have the challenge of dealing with complex transaction costs that arise all along an internationalized supply chain. Firms can have a strategy of integrating vertically a set of or all operations along the supply chain. Otherwise, they have to make contracts, alliances or ventures with firms that control the remaining operations. In the natural gas industry, firms are affected by new patterns of trade that have emerged in Europe. They need further investments in transportation capacity and interconnection to better serve their consumers. In the railway industry, firms are caught with increasing transaction costs occurring all over internationalized hinterland chains. They have to make strategic partnerships for the coordination of operations in the transport of freight, by barge and train, from the ports to the shippers.

### Institutions

In addition to transaction costs, the notion of internationalization can be interpreted with institutional economics. An institution, by stipulating the rules, structures economic exchanges (Hodgson 2006). It facilitates the adoption of new behaviors, and, conversely, it constrains behaviors in a range of choices. These rules come from the culture of a society, the system of laws and regulations, the specific rules that agents agree upon. Organizations contribute to the transmission, implementation and enforcements of these rules. So far, the nation-state, including its intermediary political levels, was providing most of the formal rules for infrastructures; but, increasingly with time, in-

ternational bodies took it over. The European Union, for example, has contributed to the advent of international institutions pertaining to infrastructures. To provide a definition, internationalization of infrastructures refers to the increasing network interconnections of infrastructures across borders, and, as a consequence, the creation of international organization to operate them, and the development of international institutions to govern them.

How is the internationalization of infrastructures shaped by institutional arrangements? Institutional arrangements at the international level affect more and more the operations of infrastructure markets. Wireless telephony requires, among others, comparable technical standards and economic clearing systems for the allocation of costs. There is a need, hence, for supranational regulation and governance. The European Union is a well known example, but there are many other supranational regulatory bodies such as the Universal Postal Union and the International Telecommunication Union. The increasing technical and economic interrelations between national infrastructures require political cooperation, under the form of transadministrative and intergovernmental cooperation, to maintain effective services. The increasing importance of supranational regulatory bodies illustrates converging national interests with respect to the operation and management of infrastructures.

In a nutshell, there is a growing variety of international institutional arrangements. Without making a sophisticated typology, we can distinguish classes of organizations: the generic-based such as the United Nations, the World Bank and the European Union; the sector-based are for example the International Telecommunication Union and the International Energy Agency; the region-based are the Pacific and Asian Communication Association and the Caribbean Association of National Telecommunications. All these organizations mediate most of the informal and formal rules that apply to infrastructure operators at the international level.

### Conclusion

The starting point of this article was the question about the economic effects of the internationalization of infrastructure. Up to a certain extent, this question need to be addressed by those who study the economics of infrastructures, because it concerns policies that nation states adopt to handle the increasing economic interdependencies with their partners though interconnected communication, transport and energy infrastructures. Three thesis can be brought forth. First, as long as infrastructures will be spread and interconnected, the questions of standardizing technologies, tariffs and operations will remain a constant issue, especially to handle the flow of new infrastructure

technologies brought by innovation. Second, firms that operates infrastructures can certainly reduce even more their transactions costs, not only by making the vertical integration of several operations under the umbrella of an organization, but also by pressing the adoption of common governance models by the countries in which they have market activities. Third, with the increase of economic exchanges around the world, states and international bodies create a variety of institutional arrangements, that covers geographic regions or technological domains, and whose form can range from intergovernmental to trans-administrative via nongovernmental.

Several questions can be asked to deepen further our understanding of the internationalization of infrastructures. At which exact pace does this phenomenon change, in particular in relation to the coevolution of technology and institutions? How does the power-play in international relations affect the adoption of advantageous standards to national industries that operate infrastructures? Are firms deterred to internationalize their activities by the increasing transaction costs along the supply chain? Is there a tendency of institutions that govern infrastructures to go global in their scope? Or will most of them likely remain limited by the boundaries of economic regions? A thing seems to be certain, though, regarding the future of infrastructures in an international context: the design of institutions that govern infrastructures will become increasingly complex with the multiplication of states and firms involved in the game. ★

#### Note

This article a revised and updated text of 'Internationalization of infrastructures' by J.-F. Auger, J.J. Bouma and R. Künneke (2009: 1–9).

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